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AM. SOC. C. E.—MANUALS OF ENGINEERING PRACTICE—NO. 18

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

SELECTED BIBLIOGRAPHY ON SOIL MECHANICS

PREPARED BY
THE COMMITTEE OF THE SOIL MECHANICS AND FOUNDATIONS DIVISION
ON
SOIL MECHANICS BIBLIOGRAPHY
ADOPTED DECEMBER 4, 1939

HEADQUARTERS OF THE SOCIETY
33 WEST 39TH ST. 1940 NEW YORK, N. Y.

MANUALS: THEIR ORIGIN AND SCOPE

(As Developed by the Technical Procedure Committee, July, 1930, and Revised to March, 1935)

A manual consists of an orderly presentation of facts on a particular subject, supplemented by an analysis of the limitations and applications of these facts. It contains information useful to the average engineer in his every-day work, rather than findings that may be useful only occasionally or rarely. It is not in any sense a "standard," however; nor is it so elementary or so conclusive as to provide a "rule-of-thumb" for non-engineers.

Furthermore, a manual, in distinction to a paper (which expresses only one person's observations or opinions), is the work of a committee or group selected to assemble and express information on a specific topic. As often as practicable the Manual Committee is under the general direction of one or more of the Technical Divisions, and the product evolved has been subjected to review by the Executive Committee of that Division. As a step in the process of this review, proposed manuals are often brought before the members of the Technical Divisions for comment, which may serve as the basis for improvement. When published, each manual shows the names of the Committee by which it was compiled and indicates clearly the several processes through which it has passed in review, in order that its merit may be definitely understood.

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SOIL MECHANICS BIBLIOGRAPHY

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HISTORICAL SUMMARY

The Committee of the Soil Mechanics and Foundations Division on Soil Mechanics Bibliography was appointed by the Executive Committee of the Division on October 11, 1936,

> " . . . to formulate and periodically to revise a bibliography of recommended literature on the subject of soil mechanics, and to facilitate its dissemination to the members of the Society."

The Committee in turn solicited the assistance of an Advisory Board of twenty-six internationally known authorities on the subject. The members of this board (listed on the opposite page) were not chosen on a basis of the personal preferences of the Committee, but as the result of a systematic compilation of all available data pertaining to the prominence of men in the field of soil mechanics, including, among other things, published accounts of membership in societies and on committees, and participation in meetings related to soil mechanics.

To include in a bibliography of this type a comprehensive list of all the thousands of publications pertaining to the subject of soil mechanics would involve much more expense than the Society felt advisable; hence a limitation of approximately 350 publications was imposed. In order to obtain a list of 350 of the most suitable and representative publications, each member of the Advisory Board was asked to submit a recommended list of between 50 and 100 items from which a final selection could be made by the Committee. The results were very surprising.

A total of 945 publications was recommended, yet only 320 of the 945 had more than one sponsor. The most popular publication had only 14 sponsors, or the recommendation of 56 percent of the Board. Only two publications were recognized by 50 percent of the Board, and only 43 by 25 percent of the Board. These figures indicate how few publications on the subject of soil mechanics have received wide recognition.

For this reason it was difficult for the Committee to curtail the 945 recommended publications to the required 350. Selections were finally made by assigning appropriate weight to:

(a) The number of Advisory Board sponsors,
(b) The necessity of including a reasonable number of items in each of the different divisions of the subject,
(c) Recommendations of the authors as to exclusion of certain of their own publications.

Although considerable time was required for the preparation and editing of the original list of items selected for the bibliography, the Advisory Board willingly rendered assistance in compiling an additional list of later publications. More than 100 of these were recommended, from which the Committee selected 32 for inclusion in the bibliography. The complete list of 1047 recommended publications is on file in the Engineering Societies Library in New York City.

Omission of a publication is not in any sense an indication of discredit, but

simply the consequence of an extremely large volume of material, and of the conscientious and painstaking endeavor of the Committee to interpret the intent of the Advisory Board.

The authors of the publications selected were invited to supply the Committee with abstracts for inclusion in the bibliography. About one-half of the abstracts were obtained by this means; the rest were worked up by the Committee.

The present list includes selected references from all available publications up to December 1, 1939. In the future it is hoped that the Committee will be authorized to publish supplementary lists each year; meanwhile, criticisms and suggestions will be greatly appreciated.

The Committee desires to express its appreciation of the great number of excellent publications which have contributed so much to the recent rapid advance in the science of soil mechanics, and regrets its inability to include a larger number in this bibliography.

The Committee is deeply indebted to Col. William E. R. Covell, M. Am. Soc. C. E., Corps of Engineers, U. S. A., Pittsburgh, Penna., and his office staff for valuable help. Thanks are also due Frank M. Mellinger and Edward M. Belknap, Juniors, Am. Soc. C. E.; Byron O. McCoy, assistant to the chairman, for suggestions and help; and T. B. Fadum, for translations. I. Gutmann, editor of *Engineering Index*, supplied a number of abstracts of selected publications. The Committee is particularly indebted to the Advisory Board for its generous and time-consuming cooperation in preparing the lists of references from which the bibliography is compiled, and to those authors who kindly consented to furnish abstracts.

SUBJECT INDEX

Because many publications embrace at the same time numerous minor subdivisions of the field, it has been necessary in order to avoid excessive cross references that the following subject index be restricted to a brief classification of the major divisions of soil mechanics. (The boldface letters given in this list correspond with those following the references in the bibliography.)

A. *General*

Publications on the subject which cover many phases of soil mechanics and foundations. Works which contain an index and which can serve as a text for students.

Items for which no allocation has been given, but which will be distributed in the revised indices accompanying subsequent reports.

B. *Properties and Classification of Soils*

Terminology, axioms, and classifications of soils; definition of tests for the purpose of classifying soils. If the procedure for such tests is given, the publication is also listed in Group **C**. Allowed stresses.

C. *Sampling and Testing*

Methods used in obtaining, treating, and transporting samples; laboratory methods of handling and preparing the sample for test.

The science of testing soils—that outline procedure which, by experiment, extracts certain relationships representing the physical properties of the soils when used in formulas or other accepted forms of analyses.

Electric and seismic foundation explorations.

Model tests, classified under the subjects to which they apply.

For field tests for bearing value of soils and piles, see Group **D**.

D. *Stresses and Settlement in Soils*

Methods of calculating or estimating stresses and stress distribution in embankments, slopes, and foundations, and the displacement, movement, and settlement therein. Distribution of applied loads of structures. Earth pressure cells. Field tests for bearing value of soils and piles.

E. *Pressures of Soils on Structures*

Methods of calculating or estimating pressures of soils on walls, shoring tunnels, and so forth, including the methods of application of these pressures in the design of such structures. For foundation reactions see Group **D**.

F. *Seepage, Capillarity, and Drainage*

Theory of flow of water through soils; methods of estimating or calculating the rate, direction, distribution, and forces of flow, including uplift and piping. Also methods, such as impregnation, blanketing, and the use of cutoffs, drains, and so forth, for reducing and controlling seepage. Piezometers. For drainage of wearing surfaces see Group **I**.

G. *Selection of and Methods of Strengthening Soils*

Methods of selecting materials for fills in embankments, drains, backfills, and so forth, and the methods employed in placing them, such as rolling, vibrating, tamping, jetting, sluicing, and so forth. Also similar methods for strengthening materials already in place, including grouting and admixtures. For wearing surface stabilization see Group **I**.

H. *Erosion, Weathering, and Silting*

Scour and erosion of rivers, canals, slopes, and beaches by currents, waves, and rain wash; silting of reservoirs, rivers, canals, and harbors; methods of prevention and control; the effects of frost action and methods of its control.

I. *Stabilization of Soils for Wearing Surfaces*

Studies and methods designed to produce wearing surfaces for highways, airports, tennis courts, and so forth by selection, grading, mixing and admixing soils, cements, asphalts, and so forth. Also, studies on subgrades and subgrade drainage in connection with stabilization for wearing surfaces only.

FINDING INDEX

The numbers listed below correspond to those preceding references in the bibliography. (Definitions of the subject headings are given in the Subject Index.)

A	B		C			D			
General	*Properties and Classification of Soils*		*Sampling and Testing*			*Stresses and Settlement in Soils*			
21	3	205	1	143	259	1	80	178	277
45	7	206	3	145	260	2	81	179	279
54	8	210	5	148	261	6	83	182	281
56	15	216	11	152	263	9	89	183	283
57	18	220	15	153	264	10	90	185	284
66	21	223	18	154	265	13	91	186	285
75	24	226	23	155	266	14	94	187	286
89	26	228	24	156	270	16	95	188	292
97	30	229	25	159	274	17	98	189	295
100	31	235	28	160	275	20	99	192	299
107	34	245	31	161	277	21	101	197	300
108	36	246	34	162	280	22	102	203	301
112	37	252	35	163	282	25	105	204	302
116	43	257	36	170	293	26	109	208	303
138	46	261	37	174	294	27	111	209	306
140	49	262	39	177	295	28	112	210	311
150	72	264	43	178	307	29	113	214	313
152	76	267	44	180	317	31	115	215	316
164	83	270	46	181	319	32	117	219	317
175	84	271	47	183	322	33	121	221	321
176	86	277	48	184	323	40	123	223	322
177	87	278	49	189	331	41	124	224	324
179	89	293	55	191	332	42	126	225	325
183	91	294	62	196	336	45	129	227	328
201	101	295	63	197	337	48	130	231	329
204	106	303	72	199	338	49	131	232	330
206	114	319	74	200	345	51	135	236	333
210	116	323	75	203	346	52	136	242	334
217	118	338	77	208	352	53	139	243	335
221	122	339	78	210	354	54	143	244	340
237	124	345	82	213	355	55	144	247	341
239	125	346	86	216	356	58	152	248	342
240	127	354	88	218		59	153	249	349
244	134		96	220		60	154	250	351
248	137		99	221		61	156	251	356
256	151		105	222		64	157	252	357
261	152		106	228		65	159	253	
271	158		110	229		66	166	259	
308	159		112	230		67	167	262	
309	161		114	235		71	168	266	
318	163		118	245		73	169	268	
327	177		125	250		74	172	271	
356	197		134	252		76	173	272	
	201		137	255		77	174	273	

The numbers listed below correspond to those preceding references in the bibliography. (Definitions of the subject headings are given in the Subject Index.)

ABBREVIATIONS

Agri.	— Agricultural, Agriculture
Agron.	— Agronomy
Am.Soc.C.E.	— American Society of Civil Engineers
Ann.	— Annual
App.	— Appendix
Appl.	— Applied
Asph.	— Asphalt
Assn.	— Association
A.S.T.M.	— American Society for Testing Materials
Bd.	— Board
Bos.Soc.C.E.	— Boston Society of Civil Engineers
Bul.	— Bulletin
Bur.	— Bureau
Chem.	— Chemical, Chemist, Chemistry
Civ. Eng.	— "Civil Engineering"
Conf.	— Conference
Cong.	— Congress
Constr.	— Construction, Constructional
Contr.	— Contracting
Coop.	— Cooperative
Ctr.	— Center
Dept.	— Department
Div.	— Division
Ed.	— Edition
Eng. News-Rec.	— "Engineering News-Record"
Exp. Sta.	— Experiment Station
Far.	— Faraday
Geol.	— Geology, Geological
Geoph.	— Geophysics, Geophysical
High.	— Highway
Hyd.	— Hydraulic
Inst. C.E.	— Institution of Civil Engineers
Int. Conf. Soil Mech.	— International Conference on Soil Mechanics and Foundation Engineering
Irr.	— Irrigation
Jour.	— Journal
Mag.	— Magazine
Math.	— Mathematical, Mathematics
Mech.	— Mechanical, Mechanics
Memo.	— Memorandum
Min.	— Mines, Mining, Minutes
Mono.	— Monograph
Nat.	— National
No.	— Number
p., pp.	— page, pages
Phil.	— Philosophical
Phys.	— Physical, Physics
Pr.	— Press
Proc.	— Proceedings
Pub.	— Public, Publication
Rd.	— Road
Rec.	— Record
Recl.	— Reclamation
Rep.	— Report
Res.	— Research
Rev.	— Review
Rheo.	— Rheology
Roy.	— Royal
Ry.	— Railway
Sci.	— Science
Ser.	— Series
Soc.	— Society
Std.	— Standard
Struc.	— Structural
Sur.	— Survey
Tech.	— Technical, Technician
Trans.	— Transactions
Transl.	— Translation
Univ.	— University
U.S. Bur. Recl.	— United States Bureau of Reclamation
U.S.D.A.	— United States Department of Agriculture
U.S.G.S.	— United States Geological Survey
Vol.	— Volume
Wash.	— Washington
West.	— Western
Wkly.	— Weekly
Wks.	— Works
Wld.	— World
W. S. Paper	— Water Supply Paper
W. W.	— Water Works

BIBLIOGRAPHY

A

1—Agatz, A., and Schultze, E., *Der Kampf des Ingenieurs gegen Erde und Wasser in Grundbau* (The Battle of the Engineer Against Soil and Water in Foundation Construction). Berlin: Springer, 1936. (276 pages.) (C, D, E, F)

Problems that confront foundation engineer; test borings for study of nature of underlying formations and ground-water conditions; determination of bearing power of ground; earth pressure theory; computation of water pressure effects; design and construction of foundations, including sheet piling and pile systems, also masonry foundations; analysis of causes of unsuccessful foundation construction.

Allton, R. A., (see **123**).

Ampt, G. A., (see **122**).

2—Anderson, P., "Formula for Passive Earth Pressure," *Civ. Eng.*, January, 1938, Vol. 8, pp. 32–33. (D, E)

Passive earth pressure defined as the opposition of cohesionless soil to lateral displacements of a vertical frictionless wall. Formula developed which expresses passive earth pressure as function of weight of earth, height below surface, angle which sloping surface makes with horizontal. This relation includes, as special case for horizontal earth surface, well-known Coulomb formula for passive earth pressure. Formula particularly useful in analyzing stresses in sheet piling driven into sloping banks.

3—Atterberg, A., "Die Plastizitaet und Bindigkeit liefernde Bestandteile der Tone" (The Constituents of Clay which Impart Plasticity and Cohesion), *Internationale Mitteilungen fuer Bodenkunde*, 1913, Vol. 3, pp. 291–330. (B, C)

Review of literature and report on author's original experimental study of causes of plasticity and cohesiveness of clays; experimental study of plastic and cohesive properties of twenty-two minerals, including kaolinite, quartz, felspar, talc, serpentine, mica, bauxite, and so forth.

B

Barber, E. S., (see **143** and **232**).

4—Barnes, D. P., "Flow and Percolation Studied Abroad," *Civ. Eng.*, July, 1933, Vol. 3, pp. 389–391. (F)

Review of experiments, at Hydraulic Laboratory of Berlin Institute of Technology, on seepage and uplift under dams, dragging force exerted against interior walls of pipe lines by flowing water, and movement of water through soils under various conditions.

5—Bauer, E. E., "Hydrometer Computations in Soil Studies Simplified," *Eng. News-Rec.*, May 6, 1937, Vol. 118, pp. 662–664. **(C)**

Tables for use in solving Stokes' formula for particle size determination of soils. Tabulation of effect of temperature and specific gravity through working ranges. Table enabling one to evaluate percentage of soil remaining in suspension.

6—Baumann, P., "Analysis of Sheet-Pile Bulkheads," *Trans.*, Am. Soc. C. E., 1935, Vol. 100, pp. 707–740. (Discussion: pp. 741–797.) **(D, E)**

Classical theory of passive earth pressure reviewed. Neglects yield of soil. Hence, neglects influence of rigidity of sheet-piles, leading to errors. These errors not on side of safety. Equation derived which expresses passive pressure as function of depth and yield. Method of analysis of stability of and stresses in sheet-pile bulkheads developed. Results compared with classical method and those obtained from full size tests. Intrinsic properties of granular soils investigated in light of new equation for passive pressure.

7—Baver, L. D., "The Atterberg Consistency Constants: Factors Affecting Their Values, and a New Concept of Their Significance," *Jour.*, Am. Soc. Agron., 1930, Vol. 22, pp. 935–948. **(B)**

Explains plasticity of soils on basis of orientation of plate-like colloidal particles. Study of various factors affecting plasticity other than those caused by water content. Means of predicting values of cohesion, compression, shear, and plowing resistance from Atterberg's constants.

8—Baver, L. D., and Winterkorn, H., "I—Sorption of Liquids by Soil Colloids: II—Surface Behavior in the Hydration of Clays," *Soil Sci.*, 1935, Vol. 40, pp. 403–419. **(B)**

Study of influence of structure of soil colloids and amount and nature of ions at surface on such colloidal properties as sorption of liquids, heat of wetting, viscosity of suspensions, zeta-potential of dispersed particles, hygroscopicity, and hydration.

9—Bell, A. L., "Lateral Pressure and Resistance of Clay and the Supporting Power of Clay Foundations," *Proc.*, Inst. C. E., 1914–1915, Vol. 199, pp. 233–272. (Discussion: pp. 273–336.) **(D, E)**

Comparison of Coulomb's and Rankine's theories of earth pressure; modification of Rankine's theory on basis of laboratory experiments for determination of ratio between vertical and lateral intensities of pressure in clay; supporting power of clay foundations; practical test of active clay pressure; investigation of position of plane of rupture in clay.

Bennett, H. H., (see **72**).

10—Bennett, R., "Pile Driving and the Supporting Capacity of Piles," *Selected Eng. Papers, No. 111*, Inst. C. E., 1931. (15 pages.) **(D)**

Theoretical derivation of series of formulas covering all conditions usually encountered in practice; application of these formulas to actual piling problem.

BERNATZIK, W., (see 262).

11—BERRY, D. S., "Stability of Granular Mixtures," *Proc.*, A. S. T. M., 1935, Part 2, Vol. 35, pp. 491–507. (Discussion: pp. 508–510.) (C, G, I)

Investigation made as part of study by Michigan State Highway Department for developing rational method for design of surface and base courses for flexible type low-cost roads; description of testing machines for determinations of load carrying capacity, deformation under load, and shearing resistance; development of vibration method for controlling degree of compaction.

12—BESKOW, G., *Tjälbildningen och Tjällyftningen* (Soil Freezing and Frost Heaving). Stockholm: Sveriges Geologiska Undersokning, Serie C, No. 375, 1935. (242 pages; English abstract, pp. 222–242.) (H)

Mathematical discussion of soil freezing and frost heaving based on field observations and experimental data; frost heaving process; hydrodynamic postulates of frost heaving theory; mechanics of capillary water suction; temperature conditions in freezing ground.

13—BESSON, F. S., "Review of Soil-Bearing Test for Columbus Water Tanks," *Eng. News-Rec.*, March 15, 1934, Vol. 112, pp. 345–346. (D)

Two different types of settlement; rates of consolidation in clay and sand under small and large unit stresses; various factors affecting rate of settlement of structure. Entirely erroneous conclusions may be drawn from small scale bearing tests. Relative sizes and depths of test area and loaded area under structure, as well as consolidation characteristics of different soils under low and high unit stresses, must be properly considered in interpreting test results.

14—BIOT, M. A., "Effect of Certain Discontinuities on the Pressure Distribution in a Loaded Soil," Harvard Univ., *Bul. No. 172* (Physics), 1935, Vol. 6, pp. 367–375. (D)

Theoretical mathematical discussion of effect on pressure distribution, taken at depth *h*, of presence at that depth of slippery rigid bed, of perfectly rough rigid bed, and of perfectly flexible but inextensible thin layer embedded in material.

15—BLAIR, G. W. S., "The Conception of Flow-Plasticity as Applied to Soils," *Soil Sci.*, 1931, Vol. 31, pp. 291–298. (B, C, G)

Definition and method of measuring of flow-plasticity of soils; types of flow of soil paste through capillary tube; flow-plasticity as index of changes in physical properties of soils; decreasing plasticity of soil by addition of lime and chalk. (Bibliography.)

BLODGETT, J. H., (see 123).

16—BOROWICKA, H., "Influence of Rigidity of a Circular Foundation Slab on the Distribution of Pressures Over the Contact Surfaces," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 2, pp. 144–149. (D)

Theoretical mathematical discussion of methods for determination of distribution of soil pressures under circular elastic slab of constant thickness,

making usual assumption that slab rests on surface of elastically isotropic material of infinite depth; soil pressure under center of slab.

17—Boussinesq, J., *Application des Potentiels à l'Etude de l'Equilibre et du Mouvement des Solides Elastiques* (Application of Potentials to Study of Equilibrium and Movement of Elastic Solids). Paris: Gauthier-Villars, 1885. (722 pages.) **(D, E)**

Theoretical mathematical treatise on application of method of potentials to analytic study of stresses and strains in ideal elastic masses, notably soils carrying loads, as well as to other problems of mathematical physics, particularly hydrodynamics, thermodynamics, and vibrations.

18—Bradfield, R., "The Chemical Nature of Colloidal Clay," Missouri Agr. Exp. Sta., *Res. Bul. No. 60*, 1923. (60 pages.) **(B, C)**

Methods and apparatus used in isolation and study of physical and chemical properties of colloidal material from subsoil of Putnam silt loam; preparation of synthetic colloidal mixture similar to natural colloid; velocity of migration of sols in electric field; effect of hydrogen ion concentration on cataphoresis of sols; buffer action of soils; studies of coagulation. (Bibliography.)

19—Brahtz, J. H. A., (see also 26 and 209), "Pressures Due to Percolating Water and Their Influence upon Stresses in Hydraulic Structures," *Trans.*, Sec. Cong. on Large Dams, Wash., D. C., 1936, Vol. 5, pp. 43–71. **(F)**

Vector analysis derivation of fundamental laws of slow viscous flow and pore pressure. Several mathematical examples given. Description of theory and technique of membrane analogy. Comparison of results by membrane analogy and exact mathematical methods illustrates accuracy attained by experimental methods. Typical nets included give pore pressures within earth dam for full and empty reservoir. Concepts of "mean" and "contact" stress defined and discussed.

20—Brandtzaeg, A., (see also 256), "Failure of a Material Composed of Non-Isotropic Elements," *Det Kgl Norske Videnskabers Selskabs Skrifter*, Nr. 2, 1927. **(D, E)**

Certain simplifying assumptions permit mathematical analysis of stresses and strains in many materials whose minute components have non-isotropic strength properties. "Wedging" action of the tendency to produce sliding failure produces lateral tension in some elements and consequent scattered lateral sliding such as is evidenced in failure of concrete compression cylinders.

21—Brenecke, L., and Lohmeyer, E., *Der Grundbau* (Foundation Engineering). Berlin: Ernst, 1927 (Vol. 1, 262 pages; new ed. announced), 1930 (Vol. 2, 278 pages), and 1934 (Vol. 3, 408 pages). **(A, B, D, F)**

Text on foundation construction; properties of foundation ground and foundation materials; testing of foundations; construction of various types of wooden, metallic, and concrete piles and sheet piling; development of foundation sites; construction of bulkheads and pile foundations for land and maritime structures; construction of open foundations on land and in water; design and construction of foundation shafts and pneumatic caissons; use of freezing process in foundation construction; underpinning; foundations in earthquake regions.

Breth, H., (see 87).

22—Bretting, A. E., "Foundation of Modern Bridges in Denmark," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 3, pp. 193–201. **(D)**

Pile and pier foundations of numerous Danish bridges. Particular attention given to Little Belt, Storstrom, and Aalborg bridge piers for which unusual methods were employed.

23—Bretting, A. E., "Soil Studies for the Storstrom Bridge, Denmark," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 1, pp. 314–327. **(C, E)**

Development of sampling and testing methods utilized for study of stress developed in steel sheet pile cofferdam for Storstrom Bridge, Denmark. Comparison of these stresses with those measured during construction.

24—Briggs, L. J., and McLane, J. W., "The Moisture Equivalents of Soils," U. S. D. A., Bur. of Soils, *Bul. No. 45*, 1907. (24 pages.) **(B, C, F)**

Apparatus and methods used in determining amount of water which various soils are capable of retaining when moisture in soil is subjected to constant centrifugal force sufficient in magnitude to remove water held in larger capillary spaces; effect of duration of test, initial water content, and speed on moisture equivalent; moisture equivalents of typical soils; relation of mechanical composition to moisture equivalent.

25—Broekman, G. H. van M., and Buisman, A. S. K., "Determination of Groundwater Tension: A Necessary Element in Investigating the Stability of Slopes," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 1, pp. 150–165. **(C, D, F)**

In stability problems it is necessary to distinguish between grain pressures and water pressures. Thus some examples of flow nets determined by graphical means are given in the laboratory at Delft. Phreatic line does not coincide with flow-line; capillary water taking measurable part in water movement in case of fine-grained materials. Thus slide can be possible while phreatic curve does not leave inside slope. Therefore, necessary to investigate non-stationary water movement in dams.

Brown, R. L., (see 256).

26—Bruggeman, J. R., Zangar, C. N., and Brahtz, J. H. A., "Notes on Analytic Soil Mechanics," U. S. Bur. Recl., *Tech. Memo. No. 592*, June 5, 1939. **(B, D, E, F)**

Treatise comprehending physical properties of earth materials, pore pressures, plastic distortions, and basic requirements of equilibrium. Rational methods of design, based on stability of critical points. General solutions given for retaining walls, earth dams, and plastic foundations.

27—Buchanan, S. J., "Levees in the Lower Mississippi Valley," *Proc.*, Am. Soc. C. E., September, 1937, Vol. 63, pp. 1304–1321. **(D, F)**

Part of symposium on applications of soil mechanics, outlining general considerations in design of levees and use of soil mechanics in solving unusual problems in connection with design of great system of levees in Lower Mississippi Valley; particularly determination of stable levee slopes, control of seepage, and selection and placement of materials.

28—Buchanan, S. J., "Technique of Soil Testing," *Civ. Eng.*, August, 1937, Vol. 7, pp. 568–572. **(C, D, F, G)**

Application of methods developed by U. S. Waterways Experiment Station to design of levees and earth dams; methods of mechanical analysis; two tests for shearing strength of soils; determining amount and rate of settlement; measuring permeability.

29—Buchholz, W., and Petermann, H., "Berechnungsverfahren fuer Ankerplatten und Wande" (Methods of Design of Anchor Slabs and Walls), *Der Bauingenieur*, 1935, Vol. 16, pp. 227–230. **(D, E)**

Principles of design of anchoring slabs for retaining walls, based on laboratory and field tests of models at Hanover Experiment Station, Germany.

30—Buckingham, E., "Studies on the Movement of Soil Moisture," U. S. D. A., Bur. of Soils, *Bul. No. 38*, 1907. (62 pages.) **(B, F)**

Experimental study demonstrating that loss of water by evaporation from points below soil surface is negligible in comparison with losses taking place at or very near surface; movement of water vapor through soil; drying of soils under arid and humid conditions; capillary action in soils; capillary potential; capillary conductivity and flow.

Buckman, H. O., (see **206**).

Buisman, A. S. K., (see **25**).

31—Buisson, M., "Shearing Tests: Compressive Tests on Cylinders," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 2, pp. 121–125. **(B, C, D)**

Comparisons drawn between tests made with Casagrande apparatus and shearing values obtained with rubber-sealed cylinders under water. Orientation of bedding planes affects friction angle. Stress distributions and dilatancy effects on void ratios of sands are discussed.

32—Bull, A., "Settlement Stresses Found with a Model," *Civ. Eng.*, August, 1937, Vol. 7, pp. 561–565. **(D)**

Procedure followed in using wire model for determining stresses produced in framed structure through settlement and lateral displacement of foundations. Simplifying assumptions, which are on side of safety when dealing with external loads, may be quite misleading in cases like one considered, giving much too low values for stresses. Model analysis, because of its simplicity and clarity, largely obviates necessity for such assumptions, yielding dependable results at minimum of mental effort. Educational value of wire model analysis emphasized.

Bureau of Reclamation, (see **311**).

33—Burmister, D. M., "Graphical Distribution of Vertical Pressure Beneath Foundations," *Trans.*, Am. Soc. C. E., 1938, Vol. 103, pp. 303–313. (Discussion: pp. 314–343.) **(D)**

Practical time-saving simplification of procedure for determining theoretical distribution of stresses beneath foundation made by use of influence line

graphical method. Set of charts given for depths of 10, 20, 40, and 80 feet for computation purposes.

34—Burmister, D. M., "Some Investigations of the Shearing Resistance of Cohesionless and Cohesive Materials," *Proc.*, A. S. T. M., 1939, Vol. 39, pp. 1071–1083. (B, C)

Certain similarities and fundamental differences in shearing phenomena of cohesionless soils, and important influence of certain aspects of testing procedures discussed in relation to interpretation of test results, and their reliability for application to solution of practical problems.

35—Burmister, D. M., "Squeeze Test for Integrity of Soil Samples," *Eng. News-Rec.*, April 22, 1937, Vol. 118, pp. 588–589. (C)

Simple test developed as control test to furnish preliminary estimate of shearing strength and degree of sample disturbance.

36—Burmister, D. M., "The Physical Characteristics of Soils, with Special Reference to Earth Structures," Dept. of Civ. Eng., Columbia Univ., *Bul. No. 6*, June, 1938. (61 pages.) (B, C)

Critical study made of physical characteristics of soils and of their interrelationships as affecting behavior characteristics. Practical methods proposed for analyzing soils, and selecting satisfactory materials for earth-dam or embankment construction.

Bussard, M. J., (see **117**).

C

37—Cain, W., "Cohesion in Earth," *Trans.*, Am. Soc. C. E., 1916, Vol. 80, pp. 1315–1325. (Discussion: pp. 1326–1341.) (B, C)

Discussion of results of experiments on various earths and clays; attention is called to small values of coefficients of friction and to large values of coefficients of cohesion of consolidated earth and clay; simple form of apparatus to illustrate principles of soil mechanics; need of system of experimenting, not only to determine laws of friction and cohesion of earth, but also coefficients of friction and cohesion for earths and clays in various stages of consolidation.

38—Cain, W., *Earth Pressure, Retaining Walls, and Bins.* New York: Wiley, 1916. (287 pages.) (E)

Textbook on theory of earth pressure, particularly Coulomb's theory, and on design of retaining walls and bins; direction and distribution of stress; computation of thrusts of non-coherent earth by graphical and analytical methods; theory of coherent earth; bin theory; discussion of experiments on model retaining walls.

39—Campbell, F. B., (see also **179**), "Modified Soil Control Proposed for Rolled-Fill Dams," *Eng. News-Rec.*, January 30, 1936, Vol. 116, pp. 158–159; March 26, 1936, Vol. 116, pp. 463–464. (C, G)

Experience with Proctor method of soil control on Sutherland Reservoir, near North Platte, Nebraska, indicating desirable changes to speed work

without loss of efficiency; soil compaction; compaction curves for very fine sandy material, showing that beyond 20 blows of tamping rod there is little change in density.

40—CAQUOT, A., *Equilibre des Massifs à Frottement Interne* (Equilibrium of Solids with Internal Friction). Paris: Gauthier-Villars, 1934. (94 pages.) **(D, E)**

Theoretical mathematical analysis of equilibrium of solid masses endowed with internal friction, particularly granular or coherent soils; apparent and physical friction; application of theory to design of foundations, retaining walls, sheet-piling bulkheads, tunnels, and silos; alignment charts.

41—CAROTHERS, S. D., "Elastic Equivalence of Statically Equipollent Loads," *Proc.*, Int. Math. Cong., 1924, Vol. 2, pp. 518–526. **(D, E)**

Theoretical mathematical analysis of stresses in earth embankments, cuts, and at retaining walls and dams, based upon assumption that earth is elastic solid.

42—CAROTHERS, S. D., "Plane Strain: The Direct Determination of Stress," *Proc.*, Roy. Soc. of London, 1920, Ser. A, Vol. 97, pp. 110–123. **(D)**

Theoretical mathematical discussion of various independent types of possible solutions of problem of direct determination of stresses in elastic solids which can be derived by operating direct on plane harmonic functions; stress equations of equilibrium in rectangular, in plane polar, and in orthogonal curvilinear coordinates, together with identical relations between strain components in each case.

43—CASAGRANDE, A., "Characteristics of Cohesionless Soils Affecting the Stability of Slopes and Earth Fills," *Jour.*, Bos. Soc. C. E., January, 1936, Vol. 23, pp. 13–32. **(B, C)**

Investigations of volume change of sands during shear-deformation lead to recognition of "critical density" at which deformation does not produce material change in volume. In less dense state deformation produces volume reduction and in more dense state volume increase. Tendency for volume reduction combined with saturated voids may lead to flow slides. Experiments illustrating liquefaction of fine saturated sand. Description of actual flow slides. Methods for compacting cohesionless soils discussed.

44—CASAGRANDE, A., *Die Aräometer-Methode zur Bestimmung der Kornverteilung von Böden und anderen Materialien* (The Hydrometer Method for the Determination of the Grain Size Distribution of Soils and Other Materials). Berlin: Springer, 1934. (56 pages.) **(C)**

Theory of hydrometer method including analysis of errors and methods for their elimination. Charts for rapid evaluation of experimental data. Accuracy of test results as influenced by different factors. Suitable equipment and test procedure for various types of soils, cement, and other materials. Suggestion for precision hydrometer.

45—CASAGRANDE, A., "Measures of Soil Behavior Are Still Imperfect," *Eng. News-Rec.*, January 7, 1937, Vol. 118, pp. 8–11. **(A, D, G, I)**

Critical review of accomplishments of soil mechanics in relation to highway engineering. Conclusion that general solution of problem of pavement and

base course design to fit actual soil conditions still remote. Experience shows routine tests on disturbed soil samples entirely insufficient. Research based on direct measurement of pertinent subgrade properties and their seasonal variations required. Advances in embankment design and construction discussed. Attention to discontinuities in foundation conditions emphasized and frequent mistakes described.

46—Casagrande, A., "Research on the Atterberg Limits of Soils," *Pub. Rds.*, October, 1932, Vol. 13, pp. 121–130. (B, C)

Atterberg's limits of consistency reviewed, with special attention to liquid and plastic limits. Relation of grain size and shape and soil structure to plasticity and practical use of these limits. Mechanical device for making liquid limit test described, which author has invented to reduce personal equation in manual performance of test. Results of research conducted with this apparatus.

47—Casagrande, A., "Seepage Through Dams," *Jour.*, New England Water Wks. Assn., June, 1937, Vol. 51, pp. 131–172. (C)

Darcy's law and general equations. Forchheimer's graphical method for determining flow nets. Entrance, discharge, and transfer conditions of line of seepage. Analytical and graphical methods for determining seepage through dams; homogeneous and compound sections. Seepage through anisotropic soils. Comparison between graphical methods, hydraulic model tests, and electric analogy method. Design of earth dams and levees.

48—Casagrande, A., "Shearing Resistance of Soils and its Relation to the Stability of Earth Dams," *Proc.*, Soils and Found. Conf., U. S. Eng. Dept., Boston, Mass., June 17–21, 1938. (C, D)

General theory of shearing resistance of soils. Theory of tests on cohesive soils and comparison of test results. Forces acting on earth dams and stability of upstream slope.

49—Casagrande, A., "The Structure of Clay and its Importance in Foundation Engineering," *Jour.*, Bos. Soc. C. E., April, 1932, Vol. 19, pp. 168–208. (Discussion: pp. 209–221.) (B, C, D)

Investigation of difference in compressibility between undisturbed and remolded clays. Hypothesis explaining such differences on basis of structural characteristics. Remolding effect of pile driving on structure of clay. Comparison of settlement of buildings founded on piles and without piles. Excavation suggested as reliable method for reducing settlements. Corroborative evidence from settlement observations.

Casagrande, A., (see also 338).

50—Casagrande, L., "Näherungsverfahren zur Ermittlung der Sickerung in geschütteten Dämmen auf undurchlässiger Sohle" (Approximate Method for Determination of Seepage Through Earth Dams on Impervious Bases), *Die Bautechnik*, 1934, Vol. 12, pp. 205–208. (F)

Based upon appropriate tests, graphic and analytical methods for determining seepage line for any discharge slope and for composite dam sections presented.

51—CASAGRANDE, L., "Setzungsbeobachtungen an Brückenbauten der Reichsautobahnen" (Settlement Observations on Structures of the German Superhighways), *Vorbericht*, des II Internationalen Brückenbaukongresses (Preliminary Report of Sec. Int. Bridge Constr. Cong.). Berlin, 1936. **(D)**

Predicted settlements usually higher than subsequently observed settlements. Observations on bridges of German national highways show good agreement with computed values.

52—CLARKE, N. W. B., and WATSON, J. B., "Pile Driving and Test Loading Records," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 2, pp. 221–227. **(D)**

Records of pile driving in Shanghai's waterlogged, consolidated silt. Bearing capacity rules discussed. Results of tests on "Raymond," "Svagr," and "Takechi" piles show unusual features.

53—CLARKE, N. W. B., and WATSON, J. B., "Settlement Records and Loading Data for Various Buildings Erected by the Public Works Department, Municipal Council, Shanghai," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 2, pp. 174–186. **(D)**

Tables, skeleton structural plans, and graphic settlement data given for representative buildings in Shanghai area. Allowable loads and existing loads cited, together with elements of building code.

54—COKER, E. G., and FILON, N. G., *Photoelasticity*. London: Cambridge Univ. Pr., 1931. (720 pages.) **(A, D)**

Elements of theory of physical optics and elasticity; historical development of photoelasticity; problems of flexure of beams; holes and cracks; stresses in planes involving straight or circular boundaries. (Bibliography.)

COLDBERG, O., (see 221).

COLLIER, T. R., (see 104).

55—CONDRON, T. L., and MATH, E. R., "Investigating a Foundation in Soft Soil," *Civ. Eng.*, April, 1932, Vol. 2, pp. 237–241. **(C, D)**

Tests of foundation conditions in swampy site for group of factory buildings; borings, test piles, and soil bearing tests; comparative estimates of cost of foundations supported on wood and concrete piles; geology of site; basis of footing design.

56—CONGRÈS DES GRANDS BARRAGES, LE PREMIER (First Congress on Large Dams), *Transactions*. (5 volumes.) **(A)**

Proceedings of First Congress on Large Dams, held in Scandinavia in 1933. Papers of interest to students of soil mechanics found in volumes 3, 4, and 5.

57—CONGRÈS DES GRANDS BARRAGES, LE SECONDE (Second Congress on Large Dams), *Transactions*. Washington: U. S. Government Printing Office, 1938. (5 volumes.) **(A)**

Proceedings of Second Congress on Large Dams, held in United States in 1936. Papers of interest to students of soil mechanics.

58—Converse, F. J., "Cast-in-Place Short Piles Show High Test Results," *Eng. News-Rec.*, December 19, 1935, Vol. 115, pp. 842–844. (D)

Results of Los Angeles tests of concrete piles, cast in place, 20 ft by 14 ft long, providing economical foundations for low- and medium-height buildings in extremely loose and friable soils; settlement of cast-in-place concrete pile under load in terms of surface area of concrete piles under different conditions of soil saturation.

59—Converse, F. J., "Distribution of Pressure under a Footing," *Civ. Eng.*, April, 1933, Vol. 3, pp. 207–209. (D)

Distribution of pressure on bottom of loaded concrete block three feet square and ten inches deep measured by eleven plunger-type pressure cells. At low loads maximum pressure was at center and minimum about halfway between center and corners. At higher loads, minimum pressure occurred at corners. Effect of friction of soil on sides of footing also observed.

60—Converse, F. J., "Movement of Building Footings Due to Earthquake Loads," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 1, pp. 77–80. (D)

Effect of oscillating lateral loads on settlement and angular displacement of footings discussed, and experimental results shown. Character of soil shown to be of prime importance in determining these factors.

61—Converse, F. J., "Settlement of Footings in Alluvial Soil," *Eng. News-Rec.*, November 28, 1935, Vol. 115, pp. 746–747. (D)

Comparative load settlement curves shown for 1, 3, and 9 sq ft plates on light micaceous sandy loam. Comparisons made of actual yield point and ultimate bearing capacity with values calculated from laboratory shear tests. Effect of change in moisture content on bearing capacity of soil.

62—Cooling, L. F., and Smith, D. B., "Improved Clay Sampler Used for Bay Bridge Borings," *Eng. News-Rec.*, June 23, 1932, Vol. 108, pp. 891–892. (C)

Device for removing specimens of clay from foundation drill holes developed; tool permits taking 5 in. or 2 in. diam. samples, 1 ft long; device has been used to depth of 273 ft below water level; handling samples.

63—Cooling, L. F., and Smith, D. B., "The Shearing Resistance of Soils," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 1, pp. 37–41. (Also in *Min. of Proc.*, Inst. C. E., June, 1936, Vol. 241, pp. 333–343.) (C)

Torsional and compressive shearing tests on both cohesive and partly granular soils. Testing techniques; representative curves of strength against water content.

64—Crandall, J. S., "Notes on Pile Driving Formulas Included in the Proposed Boston Building Code," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 2, pp. 216–220. (D)

Mechanics of pile driving, derivation of modified Hiley formula, and formula based on maximum height of fall, h_0, without penetration. Mathematical relation between these formulas permitting experimental verification of energy loss factors.

65—Crandall, J. S., "Piles and Pile Foundations," *Jour.*, Bos. Soc. C. E., May, 1931, Vol. 18, pp. 176–189. (D)

Analysis of mechanics of work done and energy lost in pile driving. Derivation of basic equation from which, by certain assumptions, the Rankine, Dutch (Woltmann), Hiley, and *Eng. News* formulas are evolved. Derivation from basic equation of driving formula based on maximum height of fall, h_0, giving zero penetration. Validity of assumption in arriving at these formulas discussed and criticized. Driving formulas only applicable to permeable soils such as sands and gravels. Action of piles in clays and silts. Calculation of load on soil caused by piles, singly and in groups.

Crowther, E. M., (see 246).

66—Cuevas, J. A., "Foundation Conditions in Mexico City," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 3, pp. 233–237. (A, D)

Description of Mexico City Basin and subsoil of Mexico City; geological antecedents; hydrological regime; prevailing winds; observations on settlement of Mexico City as whole and of individual buildings.

67—Cummings, A. E., "Distribution of Stresses Under a Foundation," *Proc.*, Am. Soc. C. E., August, 1935, Vol. 61, pp. 823–830. (D)

Problem studied both theoretically and experimentally. Compares theory and experiment and indicates several important factors which must be considered when problems of this kind are being analyzed.

D

68—Dachler, A. E., *Grundwasserstroemung* (Flow of Water in Ground). Wien: Springer, 1936. (138 pages.) (F)

Not available for abstracting.

Dams, Congresses on Large, (see 56 and 57).

69—Darcy, H. P. G., *Les Fontaines Publiques de la Ville de Dijon* (Public Fountains of the City of Dijon). Dijon: 1856. (Vol. 1: 647 pages of text. Vol. 2: atlas of drawings.) (F)

Of historical value as origin of "Darcy's Law."

70—Davidenkov, N. N., "Experimental Determination of Coefficient of Lateral Pressure of Loess Soils." (Original paper in Russian), English abstract, *Eng. News-Rec.*, December 26, 1935, Vol. 115, p. 883. (E)

Experimental study for determination of ratio of horizontal pressure on retaining walls to vertical pressure in soil; description of proving rings and slitted cylinders for acoustic determination of pressure; relaxation of backfill; derivation of design formula.

71—Davis, M. L., "Soil-Bearing Test Values on Proportional Areas," *Eng. News-Rec.*, July 11, 1935, Vol. 115, pp. 46–47. (D)

Series of soil-bearing tests made on small areas proportional to each other in same ratio that larger test area bore to area of tentatively designed foot-

ings. Data obtained from these test areas, under same unit loadings, used to make projected settlement curve for determination of soil-bearing value and amount of settlement of proposed footings under full loading. Check readings taken at regular periods for one year after full loading showed actual settlement exceptionally close to results anticipated.

72—Davis, R. O. E., and Bennett, H. H., "Grouping of Soils on the Basis of Mechanical Analysis," U. S. D. A., *Dept. Circ. No. 419*, July, 1927. (14 pages.) (B, C)

Principles of classification of agricultural soils; designation of soil classes; classification by Whitney diagram; soil classes and phases; equilateral triangle method; classification of soils based on mechanical composition. (Bibliography.)

Davis, R. P., (see 167).

73—Dawson, R. F., "Settlement of Exhibits Buildings at the Texas Centennial Central Exposition," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 1, pp. 80–85. (D)

Laboratory studies and consolidation tests on clay soils taken from foundations of exhibits buildings at Texas Centennial Central Exposition, held in Dallas, during 1936. Also gives actual settlement observations on these structures during time of construction and comparison to predicted settlements from laboratory investigation.

Daxelhofer, J. P., (see 262).

74—Deutsche Gesellschaft fuer Bauwesen, *Richtlinien fuer Bautechnische Bodenuntersuchungen* (Instructions for Technical Soil Investigations), Sec. Ed. Berlin: Beuth, 1937. (64 pages.) (C, D)

Instructions by Committee on Foundation Investigations of German Society of Construction Engineers on methods and procedures for testing foundation soils; test borings; load tests; laboratory tests of soil samples; field observations after completion of foundation construction. (Bibliography.)

75—Doggett, D., "Practical Soil Mechanics for Small Dams," *Eng. News-Rec.*, March 18, 1937, Vol. 118, pp. 409–412. (A, C, G)

Advantageous use of grain size analysis; Proctor density test; compaction with sheepsfoot rollers; use of California section in building some 30 small earth dams by Indiana Department of Conservation.

76—Doner, R. D., "A Theory of Arch Action in Granular Media," *Agri. Eng.*, July, 1936, Vol. 17, pp. 299–304. (B, D)

Mathematically derived laws involved in explanation of arch action believed to be applicable to all matter in granular state, such as cereal grains, powders, gravel, soils, and so forth; bearing of these laws upon design of wheels and agricultural instruments.

77—Dore, S. M., (see also 240 and 352), "Quabbin Dike Built by Hydraulic-Fill Methods," *Trans.*, Am. Soc. C. E., 1938, Vol. 103, pp. 1396–1413. (C, D, F, G)

Describes borrow pit and large shovel cut investigations, sluicing bin tests, construction control, and consolidation and seepage studies.

78—Dow, A. L., "Foundation Exploration in Deep Water," *Eng. News-Rec.*, October 14, 1937, Vol. 119, pp. 635–640. **(C)**

Description of obtaining 5 in. undisturbed soil samples and 1⅛ in. rock cores from 150 ton derrick boat through 120 ft of water and 164 ft of overburden for Passamaquoddy project.

79—Dücker, A., "Untersuchungen über die frostgefährlichen Eigenschaften nichtbindiger Böden" (Investigations of Frost-Hazard Properties of Non-Cohesive Soils), *Forschungsarbeiten aus dem Strassenwesen*, Vol. 17, 1939. (79 pages.) **(H)**

Experimental study of effect of texture on freezing of non-cohesive soils; freezing of texture fractions of soils and their mixtures.

Dufour, F. O., (see 219).

80—Du-Plat-Taylor, F. M., *The Design, Construction, and Maintenance of Docks, Wharves, and Piers*, Sec. Ed. London: Benn, 1934. (522 pages.) **(D, E)**

Text on engineering, commercial, and managerial aspects of port works, including chapters and appendices on calculations for design of dock and wharf walls; retaining walls, pressure on foundations; angles of repose of soils; load control for pneumatic grain elevators.

E

81—Ehrenberg, J., "Standfestigkeitsberechnung von Staudaemmen" (Calculation of the Stability of Dams), *Trans.*, Sec. Cong. on Large Dams, Wash., D. C., 1936, Vol. 4, pp. 331–386. (Abstracts: English, French, and Spanish, pp. 386–389.) **(D)**

Theoretical mathematical study of specific shearing resistance of earth slopes and earth dams; stress distribution at particular points of earth body, also in horizontal and vertical sections of homogeneous, symmetrical body of triangular form; positions of sliding surfaces in soils; use of logarithmic spirals as sliding surfaces; safety factor; static effect of water on dams; proof of stability of slopes of dams; demand made upon core structure; cross-sections of important dams in Germany.

82—Ehrenburg, D. O., "Measuring Soil Moisture," *Eng. News-Rec.*, May 13, 1937, Vol. 118, pp. 708–710. **(C)**

Tests by U. S. Bureau of Reclamation on effects of compaction, temperature, grading, and composition of soil; method and apparatus for determination of moisture in sand by electric resistance measurements.

83—Eiffert, C. H., "Shrinkage of Hydraulic Fills in Miami Conservancy Dam," *Eng. News-Rec.*, April 4, 1935, Vol. 114, pp. 482–483. **(B, D, E, G)**

Recapitulation of shrinkage records obtained since 1921 on Huffman and Germantown flood protection dams; shrinkage progress; earth pressure records.

84—Ekblaw, G. E., and Grim, R. E., "Some Geological Relations Between the Constitution of Soil Materials and Highway Construction," *Illinois State Geol. Sur.*, 1936. (B, I)

Engineering geology problems in Illinois relating to subgrade conditions and stabilized-soil roads. Surficial materials, which are mostly of glacial derivation, and modified by weathering into typical soil profiles. Large proportion of these materials the clay minerals montmorillonite and sericite-like mineral (illite) whose properties, including base-exchange capacity, are markedly different. Consequently, materials' reactions under various conditions vary greatly, and therefore identification of principal clay minerals and exchangeable base in any soil material is of prime importance before it is used in highway construction.

85—Endell, K., and Hoffman, U., "Electrochemical Hardening of Clay Soils," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 1, pp. 273–275. (G)

Experiments based on introduction into clays of electrodes such as aluminum and copper. Treated samples, immersed, retain their hardness indefinitely in comparison with untreated samples. Piles covered with electrode sheeting show improved bearing capacity through adherence of electrically hardened clay.

86—Endell, K., and Hoffman, U., "The Chemical Nature of Clays," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 1, pp. 51–54. (B, C)

Nature of clays; results of X-ray and microscopical examinations of soil colloids, showing that all clay minerals are so fine-grained, and have, therefore, such large specific surface, that certain small quantities of exchangeable kations attached to surface may be determined quantitatively by chemical or electrochemical methods; important properties of kaolin and bentonite; Debye-Scherrer X-ray diagrams of kaolin and montmorillonite; characteristics of disintegrating clay specimens.

87—Endell, K., Loos, W., and Breth, H., "Zusammenhang zwischen kolloidchemischen sowie bodenphysikalischen Kennziffern bindiger Böden und Frostwirkung" (The Relation Between Colloid Chemistry, the Physical Constants of Cohesive Soils, and Frost Effects), *Forschungsarbeiten aus dem Strassenwesen*, Vol. 16, 1939. (55 pages.) (B, G, I)

Experiments made on clay minerals, with controlled proportions of quartz, and on natural soils. Relation between particle size distribution, Atterberg limits, absorption capacity, permeability, and capillary pressure considered, and conclusions drawn with regard to influence of these properties on frost danger.

88—Eno, F. H., "Some Effects of Soil, Water, and Climate Upon the Construction, Life, and Maintenance of Highways," Ohio State Univ. Eng. Exp. Sta., *Bul. No. 85*, November, 1934. (137 pages.) (C, I)

Methods of testing soils with reference to highway construction; subgrade treatment beneath concrete pavements; subgrade treatment for traffic-bound roads; subdrainage of highways; treatment of bog holes; earth slips and their treatment; pavement displacement.

89—Ensz, H., "Soil Mechanics Applied to Foundations and Other Engineering Problems," *Jour.*, Western Soc. Engrs., April, 1936, Vol. 41, pp. 93–102. **(A, B, D)**

History of soil mechanics; structure of soils; applications to pile foundations; calculation of stresses. (Bibliography.)

F

Fahlquist, F. E., (see **352**).

Farr, D., (see **104**).

90—Feagin, L. B., "Lateral Pile-Loading Tests," *Trans.*, Am. Soc. C. E., 1937, Vol. 102, pp. 236–254. (Discussion: pp. 255–288.) **(D)**

Tests conducted at Lock and Dam No. 26, Alton, Illinois, to determine resistance under lateral loads of timber and concrete piles, driven in Mississippi River sand with heads not fixed, and with heads fixed in concrete test monoliths; fiber-stress investigation; resistance of soil relative to that of piles; effect of tests on concrete in monoliths.

Feingold, E. B., (see **285**).

91—Feld, J., "A Foundation Primer," *Civ. Eng.*, January, 1938, Vol. 8, pp. 10–14. **(B, D)**

Rational basis for design of foundations for smaller structures. Treats limitations and favorable qualities of different materials.

92—Feld, J., "Lateral Earth Pressure: The Accurate Experimental Determination of the Lateral Earth Pressure, Together with a Résumé of Previous Experiments," *Trans.*, Am. Soc. C. E., 1923, Vol. 86, pp. 1448–1505. (Discussion: pp. 1506–1598.) **(E)**

University of Cincinnati tests. Effects of surcharge and settling of fill with time. Summary and discussion of experiments from 1720 to 1920.

93—Fellenius, B., "Om beräkning av jordtryck mot spanter vid kohesionära jordarter" (On Computation of the Pressure of Cohesive Earths Against Walls), *Teknisk Tidskrift*, 1936, Vol. 66 (Supplements), Sec. V, p. 12. (English translation: Steinmo, H. L., U. S. Bur. Recl., *Tech. Memo. No. 559*, 1937.) **(E)**

Method of calculating pressures developed by cohesive earths against walls which have been reinforced with piles not driven to solid base. Figures supplied for use in practical analysis of both walls and slopes.

94—Fellenius, W., "Calculation of the Stability of Earth Dams," *Trans.*, Sec. Cong. on Large Dams, Wash., D. C., 1936, Vol. 4, pp. 445–462. **(D)**

Systematic treatise on earth statical problems, assuming cylindrical sliding surfaces. Typical methods of calculation for earth dams in compound section, taking into account the effects of water.

95—Fellenius, W., *Erdstatische Berechnungen mit Reibung und Kohäsion, Adhäsion, und unter Annahme kreiszylindrischer Gleitflächen* (Statical Analysis of Earth Slopes and Retaining Walls Considering both Friction and Cohesion, and Assuming Cylindrical Sliding Surfaces), Rev. Ed. Berlin: Ernst, 1939. (D, E)

Systematic treatise on earth statical problems, assuming cylindrical sliding surfaces. Applications made to embankment slopes, quay walls, and slides. Treatment of problems at harbor of Gotenburg given.

96—Fidler, H. A., "A Machine for Determining the Shearing Strength of Soils," *Proc.*, Soils and Found. Conf., U. S. Eng. Dept., Boston, Mass., June 17–21, 1938. (C)

Description of revised direct-shear machine in which proving rings are substituted for bellows for measurement of shear stress. Instructions for machining and calibration of rings.

Filon, N. G., (see 54).

97—Forchheimer, P., *Hydraulik* (Hydraulics). Leipzig: Teubner, 1914. (566 pages.) (A, F, H)

Treatise on hydraulics comprising following chapters of special interest to students of soil mechanics: Ch. 15, Movement of Underground Water (law of filtration, artesian and other wells, groundwater level); and Ch. 16, Effect of Water on River Bed or Sea Bottom (silting, sand dunes, and beaches).

98—Franx, C., "Proefbelasting van heipalen te Rotterdam" (Bearing Capacity of Piles Determined by Loading and Pulling Tests), *De Ingenieur*, March 31, 1933, Vol. 48, Sec. B, pp. 53–57, and April 20, 1934, Vol. 49, Sec. B, pp. 45–49. See also, "The Carrying Capacity of Piles as Computed from Pile Loading and Pulling Tests," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 1, pp. 173–180. (D)

Tests made on piles in alluvial clay underlying diluvial sand. Negative skin friction developed after soft layers were consolidated under influence of sand fill. Tests indicate toe resistance equals maximum loading capacity minus maximum pulling capacity. Piles with enlarged base show high toe resistance, and are safer with respect to negative skin friction. Pile driving formulas not to be relied upon.

99—Franzius, O., *Der Grundbau, Handbibliothek fuer Bauingenieure* (Foundation Engineering: Reference for Construction Engineers). Berlin: Springer, 1927. (360 pages.) (C, D)

Textbook on theory and practice of foundation engineering; testing of foundations and foundation materials; construction of foundations on land and under water; pile foundations; construction of cofferdam, pneumatic caisson, and other types of foundations; working under compressed air; freezing of foundation sites; equipment for construction of concrete foundations.

100—Freeman, G. L., "A Practicing Engineer Looks at Soil Mechanics," *Civ. Eng.*, December, 1938, Vol. 8, pp. 811–815. **(A)**

Review of applications of scientific soil studies, their value, and limitations.

Fröhlich, O., (see **327** and **328**).

101—Froehlich, O. K., *Druckverteilung im Baugrunde* (Pressure Distribution in Soil Foundations). Wien: Springer, 1934. (185 pages.) **(B, D, F)**

Theoretical, mathematical, and experimental studies of stresses and deformation in soils and similar materials, with special reference to plastic phenomena; elastic behavior of soils; effect of plastic phenomena on settlement of bearing surface; effect of stratification of soils and their water conditions on selection of permissible bearing value; effect of plastic flow phenomena on thick clay pipes. (Bibliography.)

102—Frontard, J., "Calculs de Stabilité des Barrages en Terre" (Calculations on the Stability of Earth Dams), *Trans.*, Sec. Cong. on Large Dams, Wash., D. C., 1936, Vol. 4, pp. 243–288. (Abstracts: English, German, Spanish, pp. 288–293.) **(D)**

Theoretical study of stability of earth dams; study of stability of fill itself, without regard to filling up of reservoir; study of modification brought to that equilibrium as result of special actions of impounded water; differential equations of sliding lines; critical height which can be given to upstream slope of fill of dam.

Frueh, G., (see **137**).

G

103—Gardner, W., "The Role of the Capillary Potential in the Dynamics of Soil Moisture," *Jour. Agri. Res.*, July 1, 1936, Vol. 53, pp. 57–60. **(F)**

Concise statement of problem of movement of water in unsaturated soil. Presence of air phase in soil-moisture complex requires modification of Darcy velocity law. Article indicates, in general terms, manner in which this law is to be modified in order to furnish satisfactory dynamical background for solution of problems in moisture movement in capillary fringe. Term "capillary potential" borrowed from classical dynamics, and methods essentially analytical.

104—Gardner, W., Collier, T. R., and Farr, D., "Groundwater: Fundamental Principles Governing its Physical Control," Utah Exp. Sta., *Bul. No. 252*, November, 1934. (40 pages.) **(F)**

Analytical discussion of application of Darcy velocity law to movement of water through soil. Discussion of terms, symbols, mathematical methods and physical laws. Summary of vector analysis and brief statement concerning mathematical theorems, differential equations, and so forth. Applications made to solution of various practical problems in drainage, well construction, sub-irrigation, watershed erosion, and so forth. Slow movement of moisture in unsaturated soil.

105—GERSEVANOV, N. M., "Models Illustrate Work of Soil Mass in Foundations," *Civ. Eng.*, October, 1935, Vol. 5, pp. 636–637. (C, D)

Review of use of mechanical models in Russian soil research work; soils with elastic skeleton; study of soil samples of undisturbed type.

106—GESSNER, H., *Die Schlamanalyse* (Sedimentation Analysis). Leipzig: Akademische Verlagsgesellschaft, 1931. (244 pages.) Also, French translation, J. P. Buffle. Paris: Dunod, 1936. (B, C)

Theoretical foundations of mechanical analysis of soils; apparatus and practical methods for mechanical analyses of soils by sifting, sedimentation, and elutriation; interpretation of analytic results and their application. Chemical and physical tables.

107—GILBOY, G., "Developments in Soil Knowledge," *Eng. News-Rec.*, February 10, 1938, Vol. 120, pp. 241–243. (A)

Résumé of progress during year 1937, including settlement observations, borings, stability of slopes, embankment foundations, and earth dams.

108—GILBOY, G., "General Remarks on Soil Mechanics Research," *Proc.*, Soils and Found. Conf., U. S. Eng. Dept., Boston, Mass., June 17–21, 1938. (A)

Review of progress in application of scientific soil studies. Discussion of fields for valuable research and some obstacles to be surmounted.

109—GILBOY, G., "Hydraulic Fill Dams," *Trans.*, First Cong. on Large Dams, Stockholm, 1933, Vol. 3, pp. 331–365, and Vol. 4, pp. 231–267. (D, F)

Presentation of methods for analyzing stability of hydraulic fill shells; determining rapidity of consolidation of core; analyzing approximately seepage through homogeneous dams on impervious foundations.

110—GILBOY, G., "Improved Soil Testing Methods," *Eng. News-Rec.*, May 21, 1936, Vol. 116, pp. 732–734. (C)

Summary of improvements made from 1934 to 1936 in apparatus for consolidation, shear, and undisturbed permeability tests.

111—GILBOY, G., "Mechanics of Hydraulic-Fill Dams," *Jour.*, Bos. Soc. C. E., July, 1934, Vol. 21, pp. 185–205. (D, F)

Analytical solution for stability of shells; two-dimensional solution for core consolidation, and simplified solution for seepage, particularly through hydraulic fill cores.

112—GILBOY, G., "Soil Mechanics Research," *Trans.*, Am. Soc. C. E., 1933, Vol. 98, pp. 218–239. (Discussion: pp. 240–308.) (A, C, D, E, F, H)

Summary of research at Massachusetts Institute of Technology up to 1933. Mechanical analyses, limit tests, permeability tests, consolidation, cohesion, and internal friction discussed under soil physics. Foundations, hydraulic fill dams, frost heaving of highways, and earth pressure on retaining walls discussed under soil engineering.

113—Gilboy, G., "Stability of Embankment Foundations," *Trans.*, Sec. Cong. on Large Dams, Wash., D. C., 1936, Vol. 4, pp. 577–592. (D)

Analysis of foundations based upon determination of principal shears, with applications to dam design, and examples from actual construction.

114—Gilboy, G., "The Compressibility of Sand-Mica Mixtures," *Proc.*, Am. Soc. C. E., February, 1928, Vol. 54, pp. 555–568. (B, C)

Experiments on initial compaction and compressibility of mixtures of sand and mica, showing influence of presence of flat grains on properties of soil, and indicating limitations of analyses on basis of grain size alone.

115—Gilboy, G., "The Scientific Method in Earthwork," *Civ. Eng.*, December, 1937, Vol. 7, pp. 827–830. (D, E)

Summary of influence of modern research on design concepts in foundations, retaining walls, and earth dams.

116—Gillette, H. S., "Elementary Soil Fundamentals," Univ. of Oklahoma Pr., 1936. (60 pages.) (A, B)

Development of engineering science of soils in America; texture of soils; review of physical properties of sands and clays; liquid and plastic limits; moisture equivalent.

117—Goldbeck, A. T., and Bussard, M. J., "The Supporting Value of Soil as Influenced by the Bearing Area," *Pub. Rds.*, January, 1925, Vol. 5, pp. 1–4. (D)

Tests made on circular areas of different size, and on soils varying from clay to sand, indicate that "the relative penetration of two areas is equal to the ratio of the square roots of the areas, for like intensities of pressure on the two areas."

118—Goldschmidt, V. M., "Undersökelser over lersedimenter" (Investigations on Clay Sediments), *Rep.*, Int. Cong. Scandinavian Soil Scientists, Oslo, 1926; also, *Nordisk Jordbrugsforskning*, Oslo, 1926, No. 1. (B, C)

Summary of investigations on chemical and mineralogical composition of clay sediments and their physical properties, particularly quaternary loams of Norway. Tabular, cleavable minerals, such as micas and chlorites, constitute up to 28 percent of Norwegian loams, and interaction of these minerals with dipole liquid, such as water, governs plastic properties of clay sediments.

119—Gottstein, E. von, *Grundsaetzliches ueber Frostschaeden an Strassen ihre Ursachen und Verhuetung* (Principal Causes of and Protection Against Frost Damages in Streets). Berlin: Volk und Reich, 1937. (H)

Not available for abstracting.

120—Graeenhan, R., "Das chemische Verfestigungsverfahren nach Dr. Joosten: Ein wertvolles Hilfsmittel fuer Gruendungen" (Dr. Joosten's Chemical Solidification Method: a Valuable Contribution to the Technique of Foundations), *Die Bauwelt*, 1931, Vol. 22, pp. 134–135. (G)

Not available for abstracting.

121—Gray, H., "Stress Distribution in Elastic Solids," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 2, pp. 157–168. **(D)**

Illustrated summary of formulas giving stresses and strains produced in semi-infinite elastic solid by various common types of surface loading. Most of formulas refer to two-dimensioned situations; for example, cases of "plane strain." Attention called to assumption inherent in application of these formulas to natural soil deposits, and question of aelotropy and discontinuity mentioned together with appropriate references thereon. (Bibliography.)

122—Green, W. H., and Ampt, G. A., "Studies on Soil Physics," *Jour. Agri. Sci.*, 1911, Vol. 4, pp. 1–24; 1912, Vol. 5, pp. 1–26. **(B)**

Not available for abstracting.

123—Gregory, J. H., Allton, R. A., and Blodgett, J. H., "Holding-Down Power of Concrete Piles," *Civ. Eng.*, February, 1933, Vol. 3, pp. 66–68. **(D)**

Results of field tests made at Columbus, Ohio, to determine holding-down power of square, precast, reinforced concrete piles.

124—Griffith, J. H., "Dynamics of Earth and Other Macroscopic Matter," Iowa Eng. Exp. Sta., *Bul. No. 117*, 1934. (152 pages.) **(B, D)**

Analyzes behavior of heterogeneous mechanical systems consisting of bodies dispersed by medium and subjected to strain. Special emphasis given to earth and engineering substructures. Dynamical laws pertaining to disperse systems as they relate to engineering formulated. Summary of dynamic laws developed given in portion of study; remainder devoted to engineering applications and supplementary problems. In development, dynamical unity and logical consistency with established principles of mathematical physics maintained, so that theories are applicable to all macroscopic matter.

125—Griffith, J. H., "Physical Properties of Earths," Iowa Eng. Exp. Sta., *Bul. No. 101*, 1931. (128 pages.) **(B, C, F)**

Researches on physical and chemical properties of loam, yellow clay, and blue clay, listing strengths in tension, compression, and shear, displacement under load, rate of percolation, colloidal contents, electrical resistance, and ceramic properties of each earth. Attempt made to discover weights of influence of different variables which affect dynamics of earth resistance, and some of more important relations that exist between these variables. Methods of testing explained and properties presented in table and graph form.

Grim, R. E., (see **80**).

126—Grover, L., "Abutment Settlement Studied by Soil Mechanics," *Eng. News-Rec.*, September 9, 1937, Vol. 119, p. 443. **(D)**

Observed settlement of steel plates buried at various elevations indicated general settlement of entire area under fill. Recommended that safe bearing capacity be computed by theory of elasticity as applied to soil mechanics.

H

127—Haines, W. B., "Studies in the Physical Properties of Soils," *Jour Agri. Sci.*, 1925, Vol. 15, pp. 529–543; 1927, Vol. 17, pp. 264–290, 297; 1930, Vol. 20, pp. 97–116. (B)

Not available for abstracting.

128—Hamel, G., "Ueber Grundwasserstroemung" (Flow of Ground-Water), *Zeitschrift fuer angewandte Mathematik und Mechanik*, June, 1934, Vol. 14, pp. 129–157. (F)

Rigorous mathematical treatment of ground-water movement on basis of Darcy's law; problem reduced to first boundary value in plane of hodograph, and completely solved in two cases.

129—Hamilton, L. W., "The Effects of Internal Hydrostatic Pressure on the Shearing Strength of Soils," *Proc.*, A. S. T. M., 1939, Vol. 39, pp. 1100–1121. (D, F)

Discusses internal pressure resulting from loading soil mass, and consequent compression of pore fluid; data on measurements of pore pressure; procedure for further analysis of shear data.

130—Hanna, W. S., and Tschebotareff, G., "Settlement Observations of Buildings in Egypt," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 1, pp. 71–77. (D)

Since construction of higher buildings began, increasing attention has been paid to settlements. Cases of conspicuous structural failure illustrated, and efficacy of several footing types considered. Laboratory correlations being sought.

131—Harris, R. M., "New Pile-Bearing Formula," *Eng. News-Rec.*, December 29, 1932, Vol. 109, p. 787. (D)

Correction and discussion of article by L. C. Wilcoxen, "New Pile-Bearing Formula from Model-Pile Tests," published in *Engineering News-Record*, November 3, 1932 (Vol. 109, pp. 524–526), which reports results of tests with homemade apparatus; resistance of piles of several shapes pressed into sand and clay; behavior of piles when driven by impact; new pile-bearing formula determined from results of impact tests.

132—Harza, L. F., "The Best Means for Preventing Piping," *Trans.*, Sec. Cong. on Large Dams, Wash., D. C., 1936, Vol. 5, pp. 139–150. (F)

Points out basic principles causing saturation at toe of earth dam and, under extreme conditions, causing formation of springs and boils, otherwise known as "piping" at toe. Also points out precautions to be taken in original construction to prevent this condition from arising, and remedies which can be applied, should this condition arise after construction completed.

133—Harza, L. F., "Uplift and Seepage Under Dams on Sand," *Trans.*, Am. Soc. C. E., 1935, Vol. 100, pp. 1352–1385. (Discussion: pp. 1386–1406.) (F)

Basic principles of flow of water through porous material; internal forces exerted on this material as result of loss of head resulting from flow through

same. Forchheimer's graphical method and hydraulic-electrical method of determining flow nets. Specific applications introduced and discussed.

134—Hatch, H. H., "Tests for Hydraulic-Fill Dams," *Trans.*, Am. Soc. C. E., 1934, Vol. 99, pp. 206–247. (Discussion: pp. 248–294.) **(B, C, F, G)**

Description of tests and formulas covering grading of materials, permeability, coefficient of friction, consolidation, and seepage with typical results.

135—Haven, R. C., "Saturation of Existing Earth Dams," U. S. Bur. Recl., *Tech. Memo. No. 493*, 1935. (29 pages.) **(D, F)**

Observations on saturation of fifteen earth-fill and hydraulic-fill dams in the United States and in India, with special reference to Belle Fourche dam in South Dakota; permeability classification; permeability coefficients and ranges.

Hendrickson, A. H., (see 339).

136—Hennes, R. G., "Analysis and Control of Landslides," Univ. of Wash., Eng. Exp. Sta., *Bul. No. 91*, 1936. (57 pages.) **(D, F)**

Soil strength may be safeguarded by preserving cohesion (through control of water content), and by preserving frictional resistance (through preventing any rapid rise of water table). Thus drainage is the most effective control measure. Piles and walls can introduce external support. Decreasing stress only other possibility of control.

137—Hertwig, A., Frueh, G., and Lorenz, H., *Die Ermittlung der fuer das Bauwesen wichtigsten Eigenschaften des Bodens durch erzwungene Schwingungen* (Determination of Most Important Characteristics of Soils by Forced Vibrations). Berlin: Springer, 1933. (45 pages.) **(B, C)**

Not available for abstracting.

138—Highway Research Board, "Soil Mechanics and Soil Stabilization," *Proc.*, 18th Ann. Meeting, High. Res. Bd., Part 2, 1938. Edited by R. W. Crum. Washington, D. C.: U. S. Government Printing Office, 1939. (433 pages.) **(A, H, I)**

Volume of thirty-two papers arranged under following headings: Soil Mechanics; Soil Stabilization; Soil-Aggregate Mixtures; Stabilization Methods; Subgrades; Frost Heaves; and Testing.

139—Hiley, A., "Pile Driving Calculations with Notes on Driving Forces and Ground Resistance," *Struc. Eng.*, July, 1930, Vol. 8, pp. 246–259; August, 1930, Vol. 8, pp. 278–288. **(D)**

Review of theory of piles and practice of pile driving; table of forces transmitted through pile and resistance overcome in ground; octagonal piles; margin of useful energy required for driving piles to given set; bearing qualities of ground; characteristics of ground resistance.

140—Hilgard, E. W., *Soils*. New York: Macmillan, 1921. **(A)**

Not available for abstracting.

141—HILL, H. M., "Seepage Through Foundations and Embankments Studied by Glass Models," *Civ. Eng.*, January, 1934, Vol. 4, pp. 32–34. (Discussion: pp. 164, 219.) (F)

Laboratory method based on fact that seepage in all cases of practical importance is laminar, and that flow between closely spaced plates of glass has the same characteristic; percolation lines through earth-fill dam on impervious foundation, as determined by glass model.

142—HINDS, J., "Upward Pressure Under Dams," *Trans.*, Am. Soc. C. E., 1929, Vol. 93, pp. 1527–1550. (Discussion: pp. 1551–1582.) (F)

Uplift measurements on several gravity dams; effect on uplift of materials deposited above dam.

HOFFMAN, U., (see 85 and 86).

143—HOGENTOGLER, C. A., and BARBER, E. S., "Essential Features of the Triaxial Shear Test," *Proc.*, A. S. T. M., 1939, Vol. 39, pp. 1028–1045; also, *Pub. Rds.*, September, 1939, Vol. 20, pp. 133–144. (C, D)

Essential features of various types of triaxial compression apparatus of stabilometers reviewed; test methods, results obtained, and their interpretation in terms of design discussed.

144—HOGENTOGLER, C. A., and TERZAGHI, K., "Interrelationship of Load, Road, and Subgrade," *Pub. Rds.*, May, 1929, Vol. 10, pp. 37–64. (D, I)

Load distribution by various types of pavements; pavement characteristics; field investigations showing that subgrade variables influence pavement condition, and that subgrade bearing properties depend on combined effect of cohesion and internal friction; precautionary measures for overcoming effects of undesirable subgrade support.

145—HOGENTOGLER, C. A., TERZAGHI, K., and WINTERMYER, A. M., "Present Status of Subgrade Soil Testing," *Pub. Rds.*, March, 1928, Vol. 9, pp. 1–8 and 24. (C)

Condensed review of soil tests; significance of various tests; interrelationship of results of different tests; simplified tests for laboratory procedure.

146—HOGENTOGLER, C. A., and WILLIS, E. A., "Essential Considerations in the Stabilization of Soil," *Trans.*, Am. Soc. C. E., 1938, Vol. 103, pp. 1163–1180. (Discussion: pp. 1184–1192.) (I)

Underlying principles involved in soil stabilization and possible means of its accomplishment discussed without any attempt to evaluate practical aspects or relative value of various methods. Particularly stressed is application of colloidal phenomena of absorption and base exchange as they affect: particles of soil, sand, crushed rock, gravel, slag, and so forth, coated with films of air, water, soluble chemical composition of aggregate and binders, and ions on surfaces of solid particles.

147—HOGENTOGLER, C. A., and WILLIS, E. A., "Stabilized Soil Roads," *Pub. Rds.*, May, 1936, Vol. 17, pp. 45–65. (I)

Two general methods for accomplishing soil stabilization, as follows: (1) by providing soil with coarse and fine materials of proportions and character

required to produce stability, and possibly supplementing this by adding chemical admixtures to maintain stability thus produced; (2) by incorporating water-insoluble binders in fine-grained or poorly graded soils, consolidating in particular manner to provide structural stability, and covering bases thus produced with thin wearing courses to furnish resistance to abrasion.

148—Hogentogler, C. A., and Willis, E. A., "Subgrade Soil Testing Methods," *Proc.*, A. S. T. M., Part 2, 1934, Vol. 34, pp. 693–725; Part 1, 1935, Vol. 35, pp. 940–982. (C, I)

Based upon constituent materials, physical properties, and performance, uniform subgrades tentatively classified in eight groups, identified by definite test limits and requiring different design features in roads laid thereon. Tentative methods of surveying and sampling soils for use in place as subgrades for highways; tests for making mechanical analysis and determining subgrade soil constants.

149—Hogentogler, C. A., Willis, E. A., and Wintermyer, A. M., "Subgrade Soil Constants, Their Significance, and Their Application in Practice," *Pub. Rds.*, June, 1931, Vol. 12, pp. 89–108; July, 1931, Vol. 12, pp. 117–144. (I)

Physical characteristics of subgrade soils which have important bearing on serviceability of road surfaces; influence exerted by condition in which soil exists, and character of its constituents upon important subgrade soil properties; and degree to which subgrade soil constants disclose presence of important subgrade characteristics.

150—Hogentogler, C. A., *et al.*, *Engineering Properties of Soils.* New York: McGraw-Hill, 1937. (434 pages.) (A)

General information on properties of soil in relation to design and construction of engineering work; general description and significance of methods used in soil examination; utilization of test results in design of stable, durable, and economic structures. Material arranged for use of instructors in engineering materials, engineering students, and practicing engineers, who desire general, yet complete, concept of physical characteristics of soils and their influence on performance of soil as engineering material.

151—Hogentogler, C. A., Jr., "Essentials of Soil Compaction," *Proc.*, High. Res. Bd., 1936, Vol. 16, pp. 309–316. (B, I)

Discusses four stages of soil wetting; hydrating, lubrication, swelling, and saturation; effect of chemical composition of soil particles and kind of absorbed ions.

152—Hool, G. A., and Kinne, W. S., *Foundations, Abutments, and Footings.* New York: McGraw-Hill, 1923. (414 pages.) (A, B, C, D, E)

Tests for determining soil conditions; bearing power of soils according to building codes; excavation methods and equipment; structural types of foundations; piles; spread footings; underpinning; foundations requiring special consideration; bridge piers and abutments.

153—Horton, D. F., "Compaction Tests on Cohesionless Materials for Rolled-Earth Dams in Boston District," *Proc.*, Soils and Found. Conf., U. S. Eng. Dept., Boston, Mass., June 17–21, 1938. (C, D, G)

Description of test, optimum water content, types of rolling equipment, and possibility of obtaining critical density.

154—Hough, B. K., Jr., "Stability of Embankment Foundations," *Proc.*, Am. Soc. C. E., September, 1937, Vol. 63, pp. 1340–1357. (C, D)

Describes soil exploration and design analysis of two large earth- and rock-fill dams to be built on massive beds of marine clay in tidal channels at Eastport, Maine. Report on difficult underwater soil sampling operations and outline of laboratory test procedure given, including description of permeability tests for conditions of turbulent flow through coarse material. Stability analysis features comparison between Jurgenson's and photoelastic methods, and introduces Haines' method by means of which embankment settlement due to lateral displacement of plastic foundation material may be estimated.

155—Housel, W. S., "A Penetration Method of Measuring Soil Resistance," *Proc.*, A. S. T. M., Part 2, 1935, Vol. 35, pp. 472–490. (C)

Simple and inexpensive apparatus for evaluating shearing resistance of plastic clay soils by observing penetration of standard core barrel for standard blow.

156—Housel, W. S., "A Practical Method of Selection of Foundations Based on Fundamental Research in Soil Mechanics," Univ. of Michigan, Dept. Eng. Res., *Bul. No. 13*, October, 1929. (117 pages.) (C, D)

Bearing capacity found by comprehensive series of load tests on clay to be function of perimeter shear and developed pressure. Simple linear equation for given settlement expresses variation in bearing capacity for different sizes of bearing areas.

157—Housel, W. S., "Bearing Power of Clay is Determinable," *Eng. News-Rec.*, February 23, 1933, Vol. 110, pp. 244–247. (D)

Data from load tests on different size bearing areas of clay. Method of analysis presented and illustrated by actual examples.

158—Housel, W. S., "Internal Stability of Granular Materials," *Proc.*, A. S. T. M., Part 2, 1936, Vol. 36, pp. 426–458. (B)

Discusses inconsistencies in internal friction theories; presents tests on five granular materials; concludes that behavior of granular masses can be described by stability of elementary arches of soil particles in which criterion of stability is horizontal thrust rather than internal friction.

159—Housel, W. S., "The Shearing Resistance of Soil: Its Measurement and Practical Significance," *Proc.*, A. S. T. M., 1939, Vol. 39, pp. 1084–1099. (B, C, D)

Shearing resistance of cohesive soils discussed with particular emphasis on those concepts of soil-water system which have led to divergent viewpoints on subject. Methods of measuring shearing resistance described, and their application to practical problems illustrated.

160—Hvorslev, M. J., "A Ring Shearing Apparatus for the Determination of the Shearing Resistance and Plastic Flow of Soils," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 2, pp. 125–129. (C)

Ring or annular shearing instrument described. Results of extensive experiments with "Vienna Clay" and "Little Belt Clay" cited. Apparatus particularly suited to testing of remolded soils, and study of plastic flow before and after failure.

161—Hvorslev, M. J., "The Shearing Resistance of Remolded Cohesive Soils," *Proc.*, Soils and Found. Conf., U. S. Eng. Dept., Boston, Mass., June 17–21, 1938. (B, C)

Discussion of properties of cohesive soils and conditions of failure. Results of tests with fully saturated remolded samples of two cohesive soils.

162—Hvorslev, M. J., "Torsion Shear Tests and Their Place in the Determination of the Shearing Resistance of Soils," *Proc.*, A. S. T. M., 1939, Vol. 39, pp. 999–1022. (C)

Describes various types of apparatus for torsion shear tests and compares practical advantages and disadvantages and sources of error in such tests with those of translatory and triaxial shear tests.

163—Hvorslev, M. J., "Über die Festigkeitseigenschaften gestorter bindiger Böden" (On the Physical Properties of Disturbed Cohesive Soils), *Ingeniør videnskabelige Skrifter,* A Nr. 45, 1937. (Copenhagen.) (B, C)

Treatise on physical properties of cohesive soils with particular reference to results of direct and ring shearing tests on "Vienna Clay" and "Little Belt Clay." Slow plastic flow before failure, and permanent and thixotropic variations after failure described. Both over- and under-consolidation considered. Ring shearing instrument explained.

I

164—International Conference on Soil Mechanics and Foundation Engineering—*Proceedings.* (3 volumes.) (A)

Conference held at Graduate School of Engineering, Harvard University, in 1936. Collection of more than two hundred and eighty papers, addresses, and discussions covering all phases of soil mechanics and foundations.

165—Israelsen, O. W., and Morgan, E. R., "Specific Water Conductivity of an Artesian Aquifer," *Trans.*, 18th Ann. Meeting, Am. Geoph. Union, Part 2, July, 1937. (F)

Methods and tests for determining coefficient of permeability (specific water conductivity) by pumping from one well and noting lowering of water table in six other adjacent wells.

J

166—Jacobs, J. D., "Five Classes of Fill in Large Dam," *Eng. News-Rec.*, August 26, 1937, Vol. 119, pp. 357–361. (D, G)

Design and construction of Inland Dam near Birmingham, Alabama.

167—Jacoby, H. S., and Davis, R. P., *Foundations of Bridges and Buildings.* New York: McGraw-Hill, 1925. (665 pages.) (D, E, G)

Covers piles and pile driving; cofferdams; caissons; pier foundations in open walls; spread foundations; bridge piers and abutments; underpinning buildings and explorations; unit loads. Several chapters devoted to piles and pile driving, covering timber piles, concrete piles, and metal piles. Chapter on box and open caissons; two on pneumatic caissons for bridges; one on pneumatic caissons for buildings. Pier foundations in open wells include Chicago method as well as freezing and grouting methods.

168—Jáky, J., "Die klassische Erddrucktheorie mit besonderer Ruchsicht auf die Stützwandbewegung" (The Classical Theory of Earth Pressures with Special Reference to the Movement of Retaining Walls), *Abhandlungen* der Internationalen Vereinigung für Brückenbau und Hochbau (*Trans.*, Int. Assn. for Bridge and Struc. Eng.), 1938, Vol. 5, S. 30. (D, E)

Theoretical and practical application of differential equations for surface of sliding failure. Rotation and parallel displacements distinguished; methods of design given for retaining walls, silos, and structural foundations.

169—Jáky, J., "The Stability of Earth Slopes," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 2, pp. 125–129. (D)

Stability of earth slopes, and methods of analysis suggested by Fellenius, Krey, and Terzaghi, examined. On basis of same assumptions, sample analytical formula for determining limiting height and slope derived. Attention drawn to bending which produces tension in upper half and compression in lower half of sliding body.

170—Jenkin, C. F., "The Pressure Exerted by Granular Material: An Application of the Principles of Dilatancy," *Proc.*, Roy. Soc. of London, 1931, Vol. 131, pp. 53–89. (C, E)

Experimental study of earth pressure and coefficients of friction in dry granular materials; arching phenomena; study leads to conclusion that direction of force on wall is inclined to normal; position of center of pressure may be much higher than one third of height of wall.

171—Jenkin, C. F., "The Pressure on Retaining Walls," *Proc.*, Inst. C. E., 1932, Vol. 234, pp. 103–154. (Discussion: pp. 155–223.) (E)

Report on several years' experimental study started at Oxford University Engineering Laboratory; design of experimental apparatus and results of measurements of pressure exerted by sand on walls of many shapes; revised wedge theory; rules for calculating forces; comparison with Resal's results; sand pressure under water; validity of tests on models.

172—Jürgenson, L., "Stability of Earth and Foundation Works and of Natural Slopes," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 2, pp. 194–200. (D)

Theories of elasticity and plasticity applied to soil supporting non-uniform load such as embankment. Effects of scale in presence of internal friction studies and practical solutions discussed.

173—Jürgenson, L., "The Application of Theories of Elasticity and Plasticity to Foundation Problems," *Jour.*, Bos. Soc. C. E., July, 1934, Vol. 21, pp. 206–241. **(D)**

Stability of foundations analyzed by comparing shearing stresses with shearing strength in foundation. Tables and diagrams supplement presentation of analytical procedure for determining stresses in elastic and plastic state, including cases with discontinuities.

174—Jürgenson, L., "The Shearing Resistance of Soils," *Jour.*, Bos. Soc. C. E., July, 1934, Vol. 21, pp. 242–275. **(C, D)**

Research on natural and remolded soil samples using unconfined compression, direct shearing, and squeezing tests in parallel leads to important conclusions. Effects of consolidation pressure, normal pressure on failure planes, duration, drainage, and preparation of samples discussed.

175—Justin, J. D., *Earth Dam Projects.* New York: Wiley, 1932. **(A)**

Describes long list of earth dam failures and successful earth dams, with chapters devoted to all major problems of earth-dam construction.

176—Justin, J. D., "The Design of Earth Dams," *Trans.*, Am. Soc. C. E., 1924, Vol. 87, pp. 1–61. (Discussion: pp. 62–139.) **(A)**

Presents six safety criteria for earth dams: ample spillway, saturation line inside toe, stable slopes under all conditions, no free water passage through dam, low escape velocity, ample freeboard against wave action.

K

177—Keen, B. A. (see also 246), *The Physical Properties of Soils.* New York: Longmans, 1931. (380 pages.) **(A, B, C, F)**

Presents critical survey of present knowledge of physical properties of soil, generalized as study of: behavior of moist, porous materials displaying colloidal properties; development of soil science since Middle Ages; development of methods and apparatus for mechanical analysis of soils; distribution and movement of water in soil; soil and clay pastes and their behavior; properties of soil and clay suspensions; physical properties of soil under field conditions; soil temperature; soil atmosphere. (Bibliography.)

178—Kimball, W. P., "Settlement Records of the Mississippi River Bridge at New Orleans," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 1, pp. 85–92. (Discussion: Vol. 3, pp. 96–99.) **(C, D)**

Settlement analysis made in 1933 of nine main piers of bridge built in 1934–35, with settlement observations up to May, 1936. Settlement analysis based on laboratory classification of four hundred sealed dry samples, and laboratory tests on ninety undisturbed samples predominantly clay and fine sand. Includes plan and profile locations, moisture contents, and Atterberg limit tests on seventy representative samples. Consolidation test results, method of computing settlements, comparison between estimated and observed settlements, and unusual effect of flood stages on pier settlements.

179—KIMBALL, W. P., "Soil Mechanics in Foundation Engineering," *Eng. Jour.*, Eng. Inst. of Canada, March, 1939, Vol. 22, pp. 113–116. **(A, D)**

Review of advances in foundation practice, comments on misuse of precedent. Examples of good and bad bearing pile practice.

180—KIMBALL, W. P., "Soils-Laboratory Device for Determining Consolidation," *Eng. News-Rec.*, February 27, 1936, Vol. 116, pp. 324–325. **(C)**

Description and detail drawing of inexpensive four-unit loading apparatus of lever-arm type for consolidation tests. Drawing of floating ring consolidation apparatus for three-inch samples. Costs itemized.

KINNE, W. S., (see **152**).

181—KJELLMAN, W., "Report on an Apparatus for Consummate Investigation of the Mechanical Properties of Soils," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 2, pp. 16–20. **(C)**

Instrument for applying homogeneous as distinguished from heterogeneous stress distribution to test samples described in detail. Changes in three principal applied stresses automatically compensated. Triaxial, diaxial, and uniaxial loadings investigated. Two-dimensional and three-dimensional failure systems investigated. Results illustrated graphically.

182—KNAPPEN, T. T., "Calculation of the Stability of Earth Dams," *Trans.*, Sec. Cong. on Large Dams, Wash., D. C., 1936, Vol. 4, pp. 505–538. **(D)**

Discussion of various principles which govern safe design of earth dams with particular reference to thirteen earth dams of Muskingum flood-control and water-conservation project in Ohio. Discussion of design of earth dam sections for various foundations also given. Embankment movement in the Tappan Dam discussed. Methods for embankment design taken up.

183—KNAPPEN, T. T., and PHILIPPE, R. R., "Practical Soil Mechanics at Muskingum," *Eng. News-Rec.*, March 26, 1936, Vol. 116, pp. 453–455 (Art. I); April 9, 1936, Vol. 116, pp. 532–535 (Art. II); April 23, 1936, Vol. 116, pp. 595–598 (Art. III); May 7, 1936, Vol. 116, pp. 666–669. (*See* May 14, 1936, Vol. 116, p. 711, for correction to Art. II, April 9, 1936.) **(A, C, D)**

Presentation of application of soil mechanics in design of foundations and embankments of thirteen dams on Muskingum flood-control project in Ohio. These dams present wide variety of problems in both embankment and foundations. Laboratory technique and methods of study presented in detail. Methods of computing embankment and foundation stresses given. Development of photoelastic method of embankment and foundation design presented. Field construction and control practice described.

184—KNEAS, F. N., "Bearing Value of Soils," *Jour.*, Franklin Inst., April, 1937, Vol. 223, pp. 443–462. **(C)**

Field and laboratory tests on clay and gravel soils, settlement observations, use of drop-penetration bar.

185—Koegler, F., "Über Baugrund-Probebelastungen" (On Foundation Loading Tests), *Die Bautechnik*, May 29, 1931, Vol. 9, pp. 357–361. (D)

Review of laboratory and field experiments, performed in Germany, Sweden, and so forth, on effect of shape and area of bearing surface on intensity of resistance of ground to superimposed loads.

186—Koegler, F., and Scheidig, A., "Druckverteilung im Baugrunde" (Pressure Distribution in Soil Foundations), *Die Bautechnik*, July 1, 1927, Vol. 5, pp. 418–421; July 15, 1927, Vol. 5, pp. 445–447; April 6, 1928, Vol. 6, pp. 205–209; April 20, 1928, Vol. 6, pp. 229–232; April 26, 1929, Vol. 7, pp. 268–272; November 29, 1929, Vol. 7, pp. 828–830. (D)

Experimental studies, including original studies by authors, on distribution of pressure under foundations; effect of rigidity of slab; deformation of loaded fills; discrepancies in theories of pressure distribution in soils; probability curve as pressure-distribution diagram; theory of spherical earth particles; determination of pressure under point of loading; newly proposed rules for design of foundations; analysis of pressure distribution under single load applied at one point, under continuous linear load and areal load; pressure distribution under rigid and elastic slabs; displacement of soil under sinking load.

187—Krey, H., *Erddruck, Erdwiderstand, und Tragfaehigkeit des Baugrundes* (Pressure, Stability, and Bearing Capacity of Soils), Fifth Ed. Berlin: Ernst, 1936. (348 pages.) (D, E)

Textbook on theory and practice of computing earth pressure; theory of stresses in earth masses, with special reference to theory of Coulomb; resistance of foundation sites to earth pressure and vertical loads; bearing and pull-out strength of piles and sheet-piling; effect of soil cohesion; computation of earth pressure on tunnel arches and in embankments; examples from practice; 118 earth-pressure tables. (Bibliography.)

188—Krynine, D. P., "Pressures Beneath a Spread Foundation," *Trans.*, Am. Soc. C. E., 1938, Vol. 103, pp. 827–849. (Discussion: pp. 850–888.) (D)

Part One contains description of graphical method of determining pressures under both uniformly and non-uniformly loaded foundations of arbitrary shape. In developing formulas for stress distribution, use has been made of conception "concentration factor," which equals 3 for elastically isotropic bodies and about 6 for sands. In former case, graphical process described furnishes strictly correct solutions. Part Two deals with rigidity of structures and their interaction with earth masses.

189—Krynine, D. P., "Some Shear Phenomena in a Loaded Soil Mass," *Civ. Eng.*, October, 1933, Vol. 3, pp. 574–576. (C, D)

Metallic punch, somewhat less than 1 in. square, pressed against edge of horizontal, moist, silty sand layer. Latter, which was large enough to imitate two-dimensional semi-infinite mass, was open from top and from side of application of load, being confined from all other sides. Slip lines obtained resemble trajectories of maximum shear, without being orthogonal, however. Another feature of experiment was bulge produced in layer of moist Ottawa sand by pressing wooden plate against its edge ("disturbed zone"). Results of this model experiment cannot be unconditionally generalized in case of actual structures.

190—Kyrieleis, W., and Sichardt, W., *Grundwasserabsenkung bei Fundierungsarbeiten* (Ground-Water Lowering in Foundation Engineering), Sec. Ed. Berlin: Springer, 1931. (286 pages.) **(F, I)**

Methods of lowering ground-water as practiced in foundation work for docks, locks, and similar structures in Europe; subject is treated theoretically and practically; well-point methods; equipment; illustrations from recent practice.

L

191—Labarre, R. V., "Test Pit Exploration Kit for Foundation Study," *Eng. News-Rec.*, August 6, 1936, Vol. 117, pp. 194–197. **(C)**

Methods and field equipment employed in testing soils in place. Shows some typical records secured. Laboratory refinements may be secured in field by apparatus which is so compact one man can assemble it in place. Describes tests for determining soil hardness, taking field samples, making field tests for shear and load settlement within shaft or in other restricted locations.

192—Ladd, G. E., "Landslides, Subsidences, and Rock Falls," *Bul.*, Amer. Railway Eng. Assn., July, 1935, Vol. 36, pp. 1091–1162. **(D, F)**

Definition and classification of landslides of unconsolidated materials; geological structures promoting slides; causes tabulated and discussed; landslide types; illustrative cases; control and preventive methods. (Bibliography.)

193—Lane, E. W., "Materials in Existing Earth Dams," *Eng. News-Rec.*, December 18, 1930, Vol. 105, pp. 961–965. **(G)**

Reviews all available data; proposes upper limits for size of material in impervious sections of rolled-fill dams, and core of hydraulic-fill dams.

194—Lane, E. W., "Security from Under-Seepage: Masonry Dams on Earth Foundations," *Trans.*, Am. Soc. C. E., 1935, Vol. 100, pp. 1235–1272. (Discussion: pp. 1273–1351.) **(F)**

Proposes modification of line of creep analysis, and gives data on many existing structures.

195—Lane, E. W., Campbell, F. B., and Price, W. H., "The Flow Net and the Electric Analogy," *Civ. Eng.*, October, 1934, Vol. 4, pp. 510–514. **(F)**

History and theory of flow net. Graphical method of construction and electrical apparatus for constructing flow nets.

Langer, K., (see 329).

196—Leadabrand, J. A., "Soil-Thread Rolling Device," *Eng. News-Rec.*, July 2, 1936, Vol. 117, p. 9. **(C)**

Usual method of obtaining thread for plastic limit test is by rolling moist soil with palm of hand. To eliminate personal element, glass plate with two one-eighth inch wire runners attached devised for rolling thread of soil. More concordant values obtained with use of this apparatus.

197—Lee, C. H., "Earth as a Basic Material of Construction," *Civ. Eng.*, August, 1931, Vol. 1, pp. 1015–1020. (B, C, D, G)

Brief, informational article pointing out ideas and aims of soil testing. Lists standard tests and tabulates various types of earth structures with appropriate tests and purposes thereof.

198—Lee, C. H., "Selecting Materials for Rolled-Fill Dams," *Civ. Eng.*, September, 1935, Vol. 5, pp. 556–557. (G)

New and improved methods of selecting component materials; requirements as to stability, watertightness, workability, insolubility, and cost; graphical definitions of mechanical analysis to satisfy requirements.

199—Lee, C. H., "Selection of Materials for Rolled-Fill Earth Dams," *Trans.*, Am. Soc. C. E., 1938, Vol. 103, pp. 1–18. (Discussion: pp. 19–61.) (C, G)

Discussion of earth testing as aid in selection of materials for rolled-fill earth dams. Pertinent fundamental principles of soil technology, as developed from latest research and practice in soils and concrete, drawn upon as basis for conclusions. Shown that particle size and grading have direct relation to more important properties of earth material. Mechanical analysis proposed as preliminary basis for determining suitability, to be confirmed by tests for compaction and permeability. Particle size and grading limits proposed in the form of graphical diagram.

200—Lee, G. A., "Slide Rule for Soil Analysis," *Civ. Eng.*, May, 1937, Vol. 7, p. 351. (C)

Slide rule for solving Stokes' Law as used for hydrometer method of determining grain sizes.

201—Leggett, R. F., *Geology and Engineering.* New York: McGraw-Hill, 1939. (650 pages.) (A, B)

Outline of science of geology. Application of geological studies to main branches of civil engineering. Reference data useful to civil engineer engaged in any geological study.

Leps, T. M., (see 294).

202—Lewis, M. R., "Flow of Ground-Water as Applied to Drainage Wells," *Trans.*, Am. Soc. C. E., 1932, Vol. 96, pp. 1194–1206. (Discussion: pp. 1207–1211.) (F)

Formulas developed for draw-down curves of: artesian wells with perforated casing extending through aquifer; wells in which water-table is in aquifer, and which penetrate its full depth; and open-bottom wells. Conclusion drawn that successful drainage by wells depends on general lowering of water-table.

Litehiser, R. R., (see 356).

Lohmeyer, E., (see 21).

203—Loos, W. (see also 87), *Praktische Anwendung der Baugrunduntersuchungen* (The Practical Application of Foundation Exploration), Third Ed. Berlin: Springer, 1939. (204 pages.) **(C, D)**

Fundamental properties of soils as foundation and structural materials; soil testing and soil testing equipment; application of soil mechanics knowledge to practical construction problems encountered in wide range of fields including—excavation, embankment slides, compaction of fills, mining, harbors, dams, highways, railways, bridge abutments, and structural foundations.

Lorenz, H., (see 137).

204—Love, A. E. H., *A Treatise on the Mathematical Theory of Elasticity*, Fourth Ed. London: Cambridge Univ. Pr., 1927. (644 pages.) **(A, D)**

Classical treatise. Following chapters of interest to students of soil mechanics: Ch. 1, Analysis of Strain; Ch. 2, Analysis of Stress; Ch. 3, Elasticity of Solid Bodies; Ch. 4, Relation Between Mathematical Theory of Elasticity and Technical Mechanics; Ch. 5, Equilibrium of Isotropic Elastic Solids; Ch. 10, Theory of Integration of Equations of Equilibrium of an Isotropic Solid Body; Ch. 13, Propagation of Waves in Elastic Solid Media.

205—Lutz, J. F., "The Physico-Chemical Properties of Soils Affecting Soil Erosion," Missouri Agric. Exp. Sta., *Res. Bul. No. 212*, 1934. (44 pages.) **(B, H)**

Experimental study of physical soil properties influencing erosiveness of Iredell sandy clay loam and non-erosiveness of Davidson clay in North Carolina, including physico-chemical studies of extracted colloids and viscosity measurements; stability of clay sols; hydration of colloidal clays; permeability of clay membranes. (Bibliography.)

206—Lyon, T. L., and Buckman, H. O., *The Nature and Properties of Soils*, Third Ed. New York: Macmillan, 1937. (392 pages.) **(A, B, F)**

Primarily agricultural in approach. Chapters of interest to engineers: Ch. 3, Physical Properties of Mineral Soils; Ch. 4, Colloidal Clay and Ionic Exchange; Ch. 7, Forms of Soil Water; Ch. 8, Soil Moisture Losses and Their Control; Ch. 9, Origin and Classification of Soil Materials; Ch. 10, Soil Formation, Classification, and Survey; Ch. 12, Soil Reaction—Soil Acidity and Alkalinity.

M

207—Marston, A., "The Theory of External Loads on Closed Conduits in the Light of the Latest Experiments," Iowa State College, *Bul. No. 96*, 1930. (36 pages.) **(E)**

Mathematical theory of loads on closed conduits due to fill materials and superloads; verification of mathematical theory of external loads on closed conduits by experiments and field observations; theory of supporting strength of rigid, semi-rigid, and flexible conduits.

208—Mason, A. B., "Correlation of Surface Loading Tests with Unconfined Compression Tests for Cohesive Soils," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 2, pp. 169–173. **(C, D)**

Progress report, from Graduate School of Engineering, Harvard University, on study of relation between settlement in surface loading test and compres-

sion of unconfined cylinder for case of cohesive soils; tests to determine minimum relative dimensions of loaded areas and size of blocks of soil needed to reduce influence of boundaries; tests on plasticine; demonstration that results of loading tests on clays can be predicted from inexpensive unconfined compression tests if strain ratio is known.

MASON, C., (see 279).

MATH, E. R., (see 55).

209—MAY, D. R., and BRAHTZ, J. H. A., "Proposed Methods of Calculating the Stability of Earth Dams," *Trans.*, Sec. Cong. on Large Dams, Wash., D. C., 1936, Vol. 4, pp. 539–576. (D)

Simplification of "slip circle" method of analysis and rational method for designing earth dams by "point to point" analysis. Non-elastic stress functions presented, which, upon differentiation, yield mean stress components termed correction stresses. These combined with basic water load and dead load stresses give principal mean stresses. These, taken with pore pressure, determine safety factors at all points.

210—MAYER, A., *Sols et Fondations* (Soils and Foundations). Paris: Colin, 1939. (201 pages.) (A, B, C, D, E, F)

Study of general methods of geotechnical laboratory work. Numerous examples of problems in structural and dam foundations, retaining walls, seepage, and so forth. Practical solution rather than finished mathematical developments emphasized.

MCLANE, J. W., (see 24).

211—MEEM, J. C., "Stresses in Cofferdams and Similar Structures," *Civ. Eng.*, December, 1934, Vol. 4, pp. 639–641. (E)

Rational theory for determining amount and point of application of lateral pressure of earth, which is at variance with Rankine's theory of earth pressure; experimental demonstration of action of earth pressure; stresses in sheet-pile cofferdam of cellular type.

212—MEINZER, O. E., "The Occurrence of Ground-Water in the United States," U. S. G. S., *W. S. Paper No. 489*, 1923. (322 pages.) (F)

Occurrence of water in rocks; porosity of granular deposits; water table; water-yielding capacity of rocks; relation of water-yielding capacity to rock texture and period of draining; methods of determining specific yield; kinds of rocks and their water-bearing properties; structure of rocks and its influence on ground-water; water-bearing formations in United States.

213—MIDDLEBROOKS, T. A., "Exploring Foundation and Dam Fill by Borings and Tests," *Eng. News-Rec.*, August 29, 1935, Vol. 115, pp. 285–290. (C, G)

Part of symposium on construction of Fort Peck hydraulic-fill dam, describing drilling program aggregating 87,000 feet of bore holes for complete determination of soil profiles and bedrock data under dam, diversion tunnel and spillway; laboratory tests of foundation samples and materials for hydraulic fill, also of methods of control of core material.

214—Miller, R. M., "Soil Reactions in Relation to Foundations on Piles," *Proc.*, Am. Soc. C. E., June, 1937, Vol. 63, pp. 1057–1080. (Discussion: September, 1937, pp. 1446–1448; October, 1937, pp. 1642–1648; December, 1937, pp. 1980–1988.) (D)

Study of behavior of combination of many soils in construction of foundations, using construction field as source of information, and correlating collected data on pile foundations under varying soil conditions; behavior of impervious soils; reactions of more pervious soils; skin friction; spacing for friction piles; pile foundation settlements. (Bibliography.)

215—Mindlin, R. D., "Force at a Point in the Interior of a Semi-Infinite Solid," *Phys.*, May, 1936, Vol. 7, pp. 195–202. (D)

Solution of three-dimensional elasticity equations for homogeneous isotropic solid satisfying boundary conditions for concentrated force acting at point in interior of semi-infinite solid. Solution is generalization of problems of Boussinesq and Cerruti for force acting at surface of semi-infinite solid, and Kelvin's problem of force acting at point in solid of indefinite extent. Results include these special problems as limiting cases.

216—Mohr, H. A., "Exploration of Soil Conditions and Sampling Operations," Harvard Univ., Soil Mech. Ser. No. 4, *Pub. No. 208*, June, 1937. (45 pages.) (B, C)

Instructions on soil testing; field identification and classification of soils; methods of underground exploration for foundation purposes; test pits and test caissons; jet probings; driven pipes and other methods; geophysical methods; analysis of typical examples.

217—Mohr, O., *Abhandlungen aus dem Gebiete der technischen Mechanik* (Papers on Engineering Mechanics), Sec. Ed. Berlin: Ernst, 1914. (568 pages.) (A, E)

Collection of fourteen papers on applied mechanics. Following two may be of interest to students of soil mechanics: Ch. 1, Equilibrium and Infinitesimal Movements of Solid Bodies; Ch. 6, Theory of Earth Pressure.

218—Moran, D. E., "Sampling and Soil Tests for Bay Bridge, San Francisco," *Eng. News-Rec.*, October 5, 1933, Vol. 111, pp. 404–406. (C)

Method of taking soil samples at great depths (250 ft) to which foundations of San Francisco-Oakland Bridge penetrate; results of sample tests; consolidation tests; testing apparatus.

219—Moran, D. E., and Dufour, F. O., "Increasing the Bearing Power of Clay Soils," *Eng. News-Rec.*, May 19, 1932, Vol. 108, p. 726. (D, G)

Use of grouting methods for improving soil directly under 9 in. reinforced concrete floor, with area of 55,000 sq ft, which was found to be settling; compacting of fill below slab by use of François cementation process.

Morgan, E. R., (see 165).

220—Morton, J. O., "Soil Surveys for Highways in New Hampshire," *Eng. News-Rec.*, May 16, 1935, Vol. 114, pp. 706–709. (B, C, I)

Method of soil group classification developed by U. S. Bureau of Public Roads; application of method to design and construction of highways in

northern states. Action of various soil types in terms of group classification. Methods employed to collect soil survey data in field, and interpretation of these data for highway engineer.

221—Mund, O., and Colberg, O., *Stuetzmauern, Grundbau* (Retaining Walls, Foundation Construction), Fourth Ed. Berlin: Ernst, 1936. (480 pages.) (A, C, D, E, G)

Textbook on design and construction of retaining walls and foundations; brief review of soil mechanics; principal theories of earth pressure and their applications to design of retaining walls; testing of foundation sites for bearing power and settlement; distribution of stresses in foundation sites; testing of soil samples in laboratory; strengthening and consolidation of unfavorable foundation sites; construction of foundations, including shoring, ground-water control, concrete placing and pile driving.

222—Muskat, M., *The Flow of Homogeneous Fluids Through Porous Media.* New York: McGraw-Hill, 1937. (763 pages.) (C, F)

Comprehensive treatise on flow of gases or liquids through sands or other porous materials. Analytical methods used in solving specific problems. Solutions derived in analytical or graphical form for great variety of problems of special interest in fields of hydrology, petroleum production, dam construction, irrigation, and so forth. Technique and results of experimental studies of these problems. (Bibliography.)

N

223—Nadai, A., and Wahl, A. M., *Plasticity: A Mechanics of the Plastic State of Matter.* New York: McGraw-Hill, 1931. (349 pages.) (B, D)

Plastic state of matter treated, with special reference to metals and mechanical engineering problems. Some applications of mechanics of plastic state to geology and geophysics. Behavior of matter under high pressure; elastic and permanent deformation; analysis of stress and strain; theory of slip lines; hardness; elastic and plastic contact problems; observations of slip lines; inherent and residual stresses; creep; pressure in interior of earth; structure of rocks due to flow.

Neal, O. R., (see 255).

224—Newmark, N. M., "Estimating Earth Pressures," *Eng. News-Rec.*, January 6, 1938, Vol. 120, pp. 23–24. (D)

Construction of chart by means of which rapid and accurate determination may be made of vertical stress due to surface loads in elastic solid.

225—Newmark, N. M., "Simplified Computation of Vertical Pressures in Elastic Foundations," Univ. of Illinois, Eng. Exp. Sta., *Circ. No. 24*, 1935. (19 pages.) (D)

Table given for calculating vertical pressures in elastic solid due to surface loading uniformly distributed over rectangular areas. Use of table for determining stresses in soil beneath foundation.

226—Nichols, M. L., "The Dynamic Properties of Soil," *Agric. Eng.*, July, 1931, Vol. 12, pp. 259–264; August, 1931, Vol. 12, pp. 321–324. (B)

Colloidal films; physics of film action in non-plastic soils; Atterberg plasticity constants; plasticity number; laws of friction; factors affecting frictional values; evaluation of soil variables; evaluation of metal variables.

227—Noekkentved, C., *Berechnung von Pfahlrosten* (Design of Pile Foundations). Berlin: Ernst, 1928. (80 pages.) German transl. of paper originally pub. in Danish. (D)

Theoretical mathematical discussion of design of systems of straight or better piles for foundations, taking into account various end conditions of piles; examples from practice; practical rules and formulas for design of pile systems.

228—Novak, V., "Kurze Uebersicht der Entwickelung der mechanischen Bodenanalyse" (Short Review of the Development of the Mechanical Analysis of Soils), *Trans.*, Third Int. Cong. Soil Sci., 1935, Vol. 2, pp. 23–36. (B, C)

Historical review of development of technique of mechanical soil analysis since beginning of nineteenth century; classification of methods of mechanical soil analyses; quantitative and graphical presentation of mechanical soil analyses; preparation of soil samples for mechanical analysis; uses of mechanical analyses in soil science.

O

229—Odén, S., "Note on the Hygroscopicity of Clay and the Quantity of Water Adsorbed per Surface-Unit," *Trans.*, Far. Soc., February, 1922, Vol. 17, pp. 244–248. (B, C, F)

Experimental and theoretical research on variation of amount of hygroscopic or adsorbed water with changing pressure of water vapor in atmosphere; obtaining at least order of magnitude of total surface area of particles from study of rate of sedimentation in clay slime and its variations during time of sedimentation; hygroscopicity found to depend not only on surface development but also on chemical nature and constitution of clay.

P

230—Paaswell, G. (see also 350), "Penetration Tests Give Bearing Power of Deep Subsurface Soils," *Eng. News-Rec.*, April 2, 1931, Vol. 106, pp. 570–572. (C)

Cone jacked into undisturbed soil through pipe jetted to desired level.

231—Paaswell, G., "Transmission of Pressure Through Solids and Soils," *Trans.*, Am. Soc. C. E., 1922, Vol. 85, pp. 1563–1577. (Discussion: pp. 1578–1600.) (D, E)

Formulas for strip loading. Theory of slides.

232—Palmer, A. A., and Barber, E. S., "The Theory of Soil Consolidation and Testing of Foundation Soils," *Pub. Rds.*, March, 1937, Vol. 18, pp. 1–23. (D, I)

Description of original apparatus and method for compression tests of soils; practical method of estimating part of total settlement of soil caused by loss of water forced vertically out of saturated compressible soil strata; application of theory to soil consolidation; development of theory of soil consolidation.

233—Palmer, L. A., "Principles of Soil Mechanics Involved in the Design of Retaining Walls and Bridge Abutments," *Pub. Rds.*, December, 1938, Vol. 19, pp. 193–207. (E)

Determination of earth pressure and stresses in soil by methods based on elasticity for problem involving plane strain. Discussion of use of Prandtl's formula, Coulomb's theory, and Moler's diagram.

234—Parsons, H. DeB., "Some Soil Pressure Tests," *Trans.*, Am. Soc. C. E., 1935, Vol. 100, pp. 1–13. (Discussion: pp. 14–54.) (E)

Measurements of horizontal pressures on stationary bulkheads, resulting from bank sand and bank gravel, 7 ft deep, alternately dry, fully saturated with water, and drained; horizontal pressures for pervious soil more dependent on angle of internal friction than on angle of repose.

235—Parsons, J. D., "Progress Report on an Investigation of the Shearing Resistance of Cohesionless Soils," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 2, pp. 133–138. (B, C)

Apparatus and methods used in study of relation between shearing resistance of cohesionless soil and normal pressure, for very light normal loads over range of horizontal load from 0 to 8.5 kg; cohesionless soils used were Ottawa sand and sharp angular crushed quartz in various grain sizes; effect of grain size and grain shape on shearing resistance; change in volume in loose and dense state during shear. (Bibliography.)

236—Pennoyer, R. P., "Design of Steel Sheet-Piling Bulkheads," *Civ. Eng.*, November, 1933, Vol. 3, pp. 615–619. (D, E)

Description of information necessary for design of steel sheet-piling bulkheads. Treats various problems of design involved, including determination of lateral earth pressures and their distribution by methods used by author for many years; depth to drive sheet-piling into soil; determination of bending moment in sheet-pile wall; loads and design methods for wales, tie-rods, and anchorage system.

237—Petermann, H., *Schrifttum über Bodenmechanik* (Soil Mechanics Bibliography). Berlin: Volk und Reich, 1937. (196 pages.) (A)

References mostly foreign.

238—Pfeiffer, P. I., "A New Method of Impermeabilizing and Improving the Physical Properties of Pervious Subsoils by Injecting Bituminous Emulsions," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 1, pp. 263–266. (G)

Description of impermeabilization process, with two examples of practical application.

239—Philippe, R. R. (see also **183**), "Soil Mechanics Applied to Design of Dams," *Civ. Eng.*, January, 1936, Vol. 6, pp. 25–28. **(A)**

Part of symposium on Muskingum Conservancy District Project dealing with soils investigations. Outline of tests and field investigation procedure leading to design of earth embankments.

240—Plummer, F. L., and Dore, S. M., *Soil Mechanics and Foundations.* New York: Pitman, 1940. (462 pages.) **(A)**

General text on foundations, earth dams, soil characteristics, and tests.

241—Prentis, E. A., and White, L., *Cofferdams.* New York: Columbia Univ. Press; Fall, 1940. (306 pages.) **(E, F, H)**

Hydrodynamics, flow of water through sand, flow nets, berms and ditches, model experiments. Erosion, Bernoulli's theorem, Chezy's formula, Du Bois' formula, model experiments and streamlining of cofferdams. Computation of lateral pressure. Practical consideration in design and construction, drainage, pump setups, revetment, closures, streamlining. Types and examples of cofferdams, with details of construction of earth dikes.

242—Prentis, E. A., and White, L., *Underpinning.* New York: Columbia Univ. Pr., 1931. (318 pages.) **(D, E)**

Subsurface exploration, movements, and examination of buildings. Preliminary support by shores, needles, and grillages. Underpinning methods of driving and jacking sectional steel piles, testing and wedging, compressed-air caisson underpinning. Examples of underpinning by pits, open caissons, needling, piles, and so forth on buildings, elevated railroads, and subways in New York City. Pretest method, with application to preconstruction of foundations, reinforcement of steel structures, soil testing. General theory of foundations, capacity of pile foundations, soil mechanics, examinations of settlement. Appendices on specifications and legal aspects. (Glossary.)

Price, W. H., (see **195**).

243—Prior, J. C., "Soil Bearing Tests for Columbus Water Tanks," *Eng. News-Rec.*, October 26, 1933, Vol. 111, pp. 500–502. **(D)**

Method of testing foundation soil for two water tanks; settlements of test columns and foundations; soil yield point; design of foundations; effect of bearing area upon settlement. (Bibliography.)

244—Proctor, C. S., "Foundations of the San Francisco-Oakland Bay Bridge," *Civ. Eng.*, December, 1934, Vol. 4, pp. 617–621; February, 1935, Vol. 5, pp. 91–95. **(A, D)**

Part I, principles of design and unprecedented conditions which required development of new type foundation. Dome type caissons sunk to maximum sinking depth of 250 ft, and to 125 ft maximum flotation depth. Increased economy, efficiency, safety, and practicability of this procedure. Part II, construction methods employed.

245—Proctor, R. R., "Fundamental Principles of Soil Compaction," *Eng. News-Rec.*, August 31, 1933, Vol. 111, pp. 245–248; September 7, 1933, Vol. 111, pp. 286–289; September 21, 1933, Vol. 111, pp. 348–351; September 28, 1933, Vol. 111, pp. 372–376. **(B, C, G)**

Los Angeles method for controlling compaction of soils; laboratory and field tests for determining suitability of available soils; data for design of dam; moisture effect on compacted density; saturated plasticity; rolled-earth dams; air-void and dry weight curves; needle determinations of moisture content and compaction; consolidation and percolation tests; swelling and bearing power; bearing power of saturated soils; experience with sheepsfoot rollers; field and laboratory tests of compact fill.

246—Puri, A. N., Crowther, E. M., and Keen, B. A., "Relation Between the Vapor Pressure and the Water Content of Soils," *Jour. Agri. Sci.*, January, 1925, Vol. 15, pp. 68–88. **(B, F)**

Not available for abstracting.

R

247—Rausch, E., *Maschinenfundamente und andere dynamische Bauaufgaben* (Machinery Foundations and Other Dynamic Problems in Construction). Berlin: Verein Deutscher Ingenieure, 1936. (111 pages.) **(D)**

Principles of design and construction of foundations for engines and other heavy machinery subjected to dynamic stresses.

Reclamation Service, United States, (see **337**).

248—Redlich, K. A., *et al.*, *Ingenieur-geologie* (Engineering Geology). Wien: Springer, 1929. (708 pages.) New edition in preparation. **(A, D)**

Text on engineering geology prepared by number of authorities with particular emphasis on subjects of importance to engineers: technical investigation of rock; properties of soils; geology of tunnels; landslides and subsidences; bearing power of soils; dam foundations; foundations on marshy ground; ground-water; changes in land due to water.

249—Rendulic, L., "Der Erddruck im Strassenbau und Brueckenbau" (Earth Pressure in Road and Bridge Construction), *Forschungsarbeiten aus dem Strassenwesen*, Vol. 10, 1938. (84 pages.) **(D, E)**

Summary of recent studies of pressure of cohesive and non-cohesive soils; distribution of earth pressure back of retaining walls; effect of age on earth pressure; pressure of embankment on its base.

250—Rendulic, L., "Der hydrodynamische Spannungsausgleich in zentral entwaesserten Tonzylindern" (Hydrodynamic Stress Balancing in Centrally Drained Clay Cylinder), *Wasserwirtschaft und Technik*, 1935, Vol. 2, pp. 250–253, 269–273. **(C, D, F)**

Results of experimental study testing Terzaghi's theory of hydrodynamic stress balancing; investigation of differential equations resulting from mathematical interpretation of these tests, bearing on problems of consolidation of clay.

251—Rendulic, L., "Ein Beitrag zur Bestimmung der Gleitsicherheit" (On the Determination of Stability Against Sliding), *Der Bauingenieur*, May 10, 1935, Vol. 16, pp. 230–233. (D)

Use of logarithmic spiral curves instead of circles for determination of earth sliding surfaces by Fellenius method.

252—Rendulic, L., "Relation Between Void Ratio and Effective Principal Stresses for a Remolded Silty Clay," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 3, pp. 48–51. (B, C, D)

Methods and results of German tests of relation between effective principal stresses and void ratio for clay in remolded state; demonstration that void ratio of clays depends exclusively on difference between total stresses and hydrostatic pressure in water content of clay; consolidation by all-sided pressure; conditions for failure.

253—Resal, J., *La Poussée des Terres:* I. *Stabilité des Murs de Soutenant;* II. *Théorie des Terres Coherentes* (Earth Pressure: Vol. 1, Stability of Retaining Walls; Vol. 2, Theory of Cohesive Soils). Paris: Béranger, 1910. (Vol. 1, 254 pages; Vol. 2, 346 pages.) (D, E)

Mathematical treatise on pressure of cohesive and non-cohesive earths; derivation of general formulas on external equilibrium of non-cohesive body; equilibrium of indefinite mass bounded by three plane surfaces or by two planes; theory of equilibrium of cohesive earths; landslides; slopes for earthwork cuts and fills; numerical tables for computation of earth pressure; note on design of French earth-fill dam completed in 1906.

254—Richards, L. A., "Capillary Conduction of Liquids Through Porous Media," *Phys.*, November, 1931, Vol. 1, pp. 318–333. (F)

Hydrodynamic laws of flow of liquids in unsaturated porous mediums; capillary conduction of water through soil and clay; hysteresis effect between capillary potential and moisture content of porous medium; forces affecting capillary action; experiments with capillary conduction.

255—Richards, L. A., and Neal, O. R., "Some Field Observations with Tensiometers," *Proc.*, Am. Soc. Soil Sci., 1936, Vol. 1. (C)

Not available for abstracting.

256—Richart, F. E., Brandtzaeg, A., and Brown, R. L., "A Study of the Failure of Concrete Under Combined Compressive Stresses," Univ. of Illinois, Eng. Exp. Sta., *Bul. No. 185*, 1928. (102 pages.) (A, E)

Investigation of failure of concrete under compressive stresses applied in one, two, or three directions perpendicular to each other; tests of internal action of material as it breaks down under compressive stress; influence of lateral stresses upon ability of concrete to resist longitudinal stresses.

257—Ries, H., *Clays: Their Occurrence, Properties, and Uses*, Third Ed. New York: Wiley, 1927. (613 pages.) (B)

Origin, composition, properties, tests, distribution of clay deposits in United States and Canada.

258—Rifaat, I., *Die Spundwand als Erddruckproblem* (The Sheet-Piling Wall as an Earth Pressure Problem). Zurich: Leemann, 1935. (89 pages.) (E)

Reviews theory of earth pressure and outlines mathematical analysis of stresses at rigid and elastic sheet-piling walls; laboratory tests on models of sheet-piling walls to determine magnitude of earth pressure and its distribution with respect to depth; resistance coefficients of sheet-piling walls; practical applications. (Bibliography.)

259—Robeson, F. A., "A Method of Predicting Settlement of Fills Placed on Muck Beds," *Pub. Rds.*, February 12, 1936, Vol. 12, pp. 249–266. (C, D)

Use of Terzaghi compression testing apparatus for computing and measuring settlements of relatively stiff and soft mucks; typical load compression curves; relative rates of consolidation of soil stratum and soil sample; length of time required for complete fill settlement; estimation of settlement by approximate method.

260—Robinson, C. W., "Tests for the Permeability of Soils," *Jour.*, Bos. Soc. C. E., July, 1938, Vol. 25, pp. 394–408. (C, F)

Detailed description of acceptable test methods. Unique use of piezometers for measuring influence of various factors on flow and structure of sample.

261—Robinson, G. W., *Soils: Their Origin, Classification, and Constitution.* New York: Van Nostrand, 1932. (390 pages.) (A, B, C)

Text on soils with agricultural viewpoint. Following chapters may be of interest to engineers: Ch. 2, Constitution of Soils; Ch. 3, Pedogenic Process; Ch. 4, Clay Complex; Ch. 5, Base Exchange and Other Reactions of Colloidal Complex; Ch. 7, General Physical Properties of Soils; Ch. 8, Water Relationships of Soils; Ch. 15, Classification of Soils; Ch. 17, Soil Surveys; Ch. 18, Soil Analysis.

262—Rodio, G., Bernatzik, W., and Daxelhofer, J. P., "Erosion Interne et Autres Phénomènes Singuliers Affectant la Stabilité des Massifs Pulverents Saturés d'Eau" (Internal Erosion and Certain Other Phenomena Affecting the Stability of Saturated Granular Masses), Centre d'Etudes et de Recherches Geotechniques (Center for Geotechnical Study and Research, Paris), *Bul. No. 5*, 1937. (B, D, F)

Fundamental properties of sands with particular reference to relations between void ratio and settlement, as well as effects of internal erosion (piping) and regressive erosion. Subsidence near Mostagenem analyzed and reported upon in light of general study.

263—Rowe, E. A., "Field Testing Devices for Hydraulic Fills," *Eng. News-Rec.*, January 31, 1935, Vol. 114, pp. 150–152. (C)

Description of simple field apparatus used on El Capitan Dam in San Diego, California; including explanation of tool for sampling core, balance for determining mining water content and voids, apparatus for screen analysis.

264—Russell, E. W., "Interaction of Clay with Liquids and Crumb Formation in Soils," *Trans.*, Roy. Soc. Phila., August 14, 1934, Vol. 233, pp. 361–389. (B, C)

Mechanism of crumb formation; influence of electrolytes on particle cementation; experiments on crumb formation and crumb stability; determination

of specific volume of clays in different liquids; properties of wetting liquid affecting specific volume of clay.

265—Rutledge, P. C., "Recent Developments in Soil Testing Apparatus," *Jour.*, Bos. Soc. C. E., October, 1935, Vol. 22, pp. 223–252. (C)

Apparatus for performance of consolidation tests, direct permeability tests, unconfined compression tests, and direct shear tests on clays and direct shear tests on sands. Special loading equipment designed and constructed for Harvard Soil Mechanics Laboratory. Experimental technique and data resulting from tests considered briefly.

266—Rutledge, P. C., "Theories of Failure of Materials Applied to the Shearing Resistance of Soils," State College, Penna., Paper before S. P. E. E., Civ. Eng. Div. Conf. on Soil Mech., June, 1939. (C, D)

Various theories for limiting conditions of stress at failure of homogeneous solids. Relation of these theories to failure of soils. (Bibliography on theories of failure and tests for conditions of failure of soils.)

S

267—Scheidig, A. (see also 170), *Der Loess und seine geotechnische Eigenschaften* (Loess and Its Geotechnical Properties). Dresden: Steinkopff, 1934. (234 pages.) (B)

Not available for abstracting.

268—Schleicher, F., "Die Verteilung der Bodenpressungen unter starren Gründungskörpern" (Distribution of Soil Pressures Under Rigid Foundation Bodies), *Der Bauingenieur*, April 28, 1933, Vol. 14, pp. 242–245. (D)

Study of distribution of stresses on pier foundations of new Ludwigshafen-Mannheim bridge over Rhine River, Germany, in accordance with theory of elastic-isotropic semi-bounded bodies ("Halbraum"); tests of small models are not applicable to large areas.

269—Schmid, H., "Statische Probleme des Tunnel und Druckstollenbaues" (Static Problems of the Tunnel and Pressure Tunnels). English transl. by C. Voetsch, U. S. Bur. Recl., *Tech. Memo. No. 262*, 1931. (E)

Investigation of tunnel construction, particularly exterior actions of forces acting on tunnels.

270—Schofield, R. K., "The pF of Water in Soil," *Trans.*, Third Int. Cong. Soil Sci., Vol. 2, pp. 37–48. (London: Murby, 1935.) (B, C, F)

Critical review of American and European literature on laws of soil water movement; original experimental study of soil moisture relationships based on energy considerations and introducing new pF scale which is logarithm of height, in centimeters, of the equivalent water column, or logarithm of Buckingham's "capillary potential"; determination of pF by direct suction, freezing point, vapor pressure, vertical columns, centrifuge, and absorbent materials. (Bibliography.)

271—SCHOKLITSCH, A., *Der Grundbau* (Foundation Engineering). Wien: Springer, 1932. (490 pages.) **(A, B, D, F)**

Properties of soils and foundation materials, and their behavior in water; sheet-piling; excavating; preparation of ground for foundation; special types of foundations; foundation site drainage.

SCHULTZE, E., (see **1**).

272—SEAQUIST, W. H., "The Goldbeck Cell in Laboratory Tests," *Eng. News-Rec.*, June 7, 1934, Vol. 112, pp. 730–732. **(D, E)**

Description of improved Goldbeck cell; test results of pressure cell as determined by precise laboratory methods.

273—SEIFERT, R. *et al.*, *Bestehen Zusammenhaenge zwischen Rutschneigung und Chemie von Tonboden?* (Is There a Relationship Between Sliding Slope and Chemical Composition of Clay Soils?). Berlin: Eigenverlag der Versuchsanstalt fuer Wasserbau und Schiffbau, 1935. **(D)**

Not available for abstracting.

274—SHEPARD, E. R., "New Soil Sampler for Deep Tests," *Eng. News-Rec.*, June 4, 1936, Vol. 116, pp. 804–805. (See also **155**.) **(C)**

Description of sampler, developed in construction of piers for San Francisco-Oakland Bay Bridge, requiring no casing for deep foundation tests; retractible plug in end of tube permits driving to desired depth; cost and time of sampling greatly decreased.

275—SHEPARD, E. R., "Searching for Foundation Beds by Electricity and Sound," *Eng. News-Rec.*, August 15, 1935, Vol. 115, pp. 228–232. **(C)**

Outline of principle and description of simplified portable apparatus for measuring earth resistivity, and for seismic subsurface surveys for determining depth to rock.

SICHARDT, W., (see **190**).

276—SLICHTER, C. S., "Theoretical Investigation of Motion of Ground-Waters," *19th Ann. Rep.*, U. S. G. S., 1898, Part 2, pp. 295–384. **(F)**

Theoretical investigation of general problem of flow of water through porous soils or rock; theoretical expression for flow of water or other fluid through column of soil made up of grains of nearly uniform size and of approximately spherical form; relation of porosity to average arrangement; movements of water in soils and rock.

277—SMALL, G., "Proposed New Boston Building Code," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 2, pp. 308–318. **(B, C, D)**

Proposed code provisions regarding: excavations, depth of foundations, borings and test pits, classification and allowable loads of foundation bearing materials, allowable load on piles, load tests of bearing materials; pile loading tests.

SMITH, D. B., (see 62 and 63).

278—SMITH, W. O., "Final Distribution of Retained Liquid in Ideal Uniform Soil," *Phys.*, December, 1933, Vol. 4, pp. 425–438. (B, F)

Theoretical mathematical study of distribution of liquids, after drainage, in idealized soil consisting of assemblage of spheres, of single size, packed at random; theoretical determination of limits of pendular, funicular, and saturation zones; determination of total liquid retention in each zone above saturation and in any lamina above free liquid; theoretical results are compared with experimental data published by F. H. King in 1898.

SOIL MECHANICS AND FOUNDATION ENGINEERING, INTERNATIONAL CONFERENCE ON, (see 164).

279—SPANGLER, M. G., MASON, C., and WINFREY, R., "Experimental Determinations of Static and Impact Loads Transmitted to Culverts," Iowa State College, Eng. Exp. Sta., *Bul. No. 79*, 1926. (80 pages.) (D, E)

Report on experimental results obtained with truck at rest; impact results with similar truck in motion; field results closely approximate theoretical loads as calculated by formula derived by Boussinesq; impact data compared with theoretical curve for static loads; tables and curves.

280—STANTON, T. E., JR., "Improved Type of Sampler for Undisturbed Samples Depth up to 250 Feet," *Calif. High. and Pub. Wks.*, July, 1936, Vol. 14, pp. 12–13 and 20; *Rds. and Rd. Constr.*, September 1, 1936, Vol. 14, pp. 271–272. (C)

Detailed description of sampler developed as result of need for deep foundation investigations of San Francisco bridges.

281—"STATENS JÄRNVÄGARS GEOTEKNISKA KOMMISSION, *Slutbetänkande*" (*Final Rep.*, Geotechnical Commission, Swedish State Railways), 1914–1922. (D)

Extensive study of ground conditions, including several monographs on particular slides and remedial measures; descriptions of field and laboratory techniques, and analytical treatment of field conditions.

282—STEARNS, N. D., "Laboratory Tests on Physical Properties of Water-Bearing Materials," U. S. G. S., *W. S. Paper No. 596-F*, 1927, pp. 121–176. (C, F)

Quantitative experimental studies of hydrologic properties of water-bearing materials; apparatus and methods used in making tests of mechanical composition, porosity, moisture equivalent, and permeability; interpretation and use of these data; outline of work by Hazen, King, and Slichter on effective size in relation to permeability.

283—STEINBRENNER, W., "A Rational Method for the Determination of the Vertical Normal Stresses Under Foundations," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 2, pp. 142–143. (D)

Nomograms prepared for solution of stresses at any point under building foundation. Stresses read directly from nomogram by superimposing transparent plan of building foundation.

284—Steinbrenner, W., "Der Einfluss einer durch starke Regen verursachten Grundwasserströmung auf die Standfestigkeit von Erdkörpern" (The Stability of Earth Slopes Under the Influence of the Ground-Water Flow Produced by Severe Rain), *Der Bauingenieur*, March 18, 1938, Vol. 19, pp. 164–168. (D, F)

Extent of effect of severe rain illustrated with two simple examples. Treatment goes beyond previous practice of considering merely reduction in angles of internal friction.

285—Stephenson, H. K., and Feingold, E. B., "Foundation Soil Overloading in Penetration Test," *Eng. News-Rec.*, August 11, 1932, Vol. 109, pp. 161–162. (D)

Experimental study of failure of foundation under main tower footing of St. Anthony's Church in Toledo, Ohio; analyses made to determine bearing capacity of soil and stresses produced by church structure in underground; possible effects on underground of construction of adjacent sewer tunnel; graph of penetration test; relation between penetration and values of shear and pressure resistance at bearing capacity limit.

286—Summers, H. J., "Determining Bearing Power in Earth Foundations," *Eng. News-Rec.*, April 19, 1934, Vol. 112, pp. 499–501. (Correction: June 7, 1934, Vol. 112, p. 747.) (D)

Theory and interpretation of bearing tests conducted for foundation of elevated water tank; time-settlement and load-settlement curves.

287—Sun, P., "Coulomb's Theory of Earth Pressure Rectified," *Civ. Eng.*, May, 1934, Vol. 4, pp. 255–257. (E)

Algebraic and graphical methods for determination of point of application of resultant earth pressure, assuming trapezoidal distribution of pressure on wall and on plane of rupture, in accordance with recent experiments; Rebhann's graphic method of determining magnitude and point of application of earth pressure.

T

288—Taber, S., "Freezing and Thawing of Soils as Factors in the Destruction of Road Pavements," *Pub. Rds.*, August, 1930, Vol. 11, pp. 113–132. (H, I)

Description of apparatus and technique used in investigation of ways in which freezing and thawing of soils may affect pavements; ice segregation in soils; tests with soils containing bentonite; surface load effect on ice segregation; thawing and refreezing destructive to road pavements; determining relative heaving properties of soils.

289—Taber, S., "Frost Heaving," *Jour. of Geol.*, July–August, 1929, Vol. 37, pp. 428–461. (H)

Laboratory investigation of problems connected with frost heaving; pressure effects accompanying freezing of soils due to growth of ice crystals; pressure developed in direction of crystal growth; chief factors controlling segregation and excessive heaving; differential heaving due chiefly to differences in soil texture, amount of available water, and amount of soil cover.

290—Taber, S., "The Mechanics of Frost Heaving," *Jour. of Geol.*, May–June, 1930, Vol. 38, pp. 303–317. (H)

Theory of frost heaving of soils based on experiments and field observations.

291—Taylor, D. W., "Lateral Pressures of Cohesionless Soils in Retaining Wall Designs," *Eng. News-Rec.*, July 16, 1936, Vol. 117, p. 76. (E)

Nomographic chart for use in determination of retaining wall pressures, with brief discussion of its source and applicability of earth pressure formulas in general.

292—Taylor, D. W., "Stability of Earth Slopes," *Jour.*, Bos. Soc. C. E., July, 1937, Vol. 24, pp. 197–246. (D)

Derivations and charts for general solution of stability of simple slope of uniform material with shearing stress that may be expressed by $c + p \tan \phi$; comparisons of existing methods; suggestions for handling cases involving drawdown and seepage; discussion of surface cracking and other uncertainties; illustrative problems.

293—Taylor, D. W., "The Critical Density of Granular Materials: A Comparison of Results of Direct Shear and Cylindrical Compression Tests," *Proc.*, A. S. T. M., 1939, Vol. 39, pp. 1058–1070. (B, C)

Essential features reviewed. Comparisons presented for four sands of the following: friction angles, stress-strain curves, critical void-ratios. "Equal-strength void-ratio," based on constant volume tests, proposed for determining critical densities.

294—Taylor, D. W., and Leps, T. M., "Shearing Properties of Ottawa Standard Sand as Determined by the M. I. T. Strain-Control Direct Shearing Machine," *Proc.*, Soils and Found. Conf., U. S. Eng. Dept., Boston, Mass., June 17–21, 1938. (B, C)

Relation of angle of internal friction of Ottawa sand to void-ratio and normal pressure on plane of shear determined by tests with constant-strain direct-shear machine. Method suggested for determining actual shearing strains and critical void-ratio.

295—Ter-Stepanian, G., "On the Influence of Scale-Like Shape of Clay Particles on the Process of Shear in Soils," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 2, pp. 112–116. (B, C, D)

Methods and apparatus developed by Scientific Institute of Structural Research, Leningrad, U. S. S. R., for study of character of relative shearing stress displacement curves in fine-grained powder and soils; behavior of oriented scale-like micaceous particles in soils during shear; Russian 1933 series of experiments with pulverized mica (phlocopite) and quartz; experiments with fine silty sands and remolded varve clay; theory of excessive shearing strains; experiments with incompletely consolidated mica and with clay.

296—Terzaghi, K., "A Fundamental Fallacy in Earth Pressure Computations," *Jour.*, Bos. Soc. C. E., April, 1936, Vol. 23, pp. 71–88. (See also **304**.) **(E)**

Demonstrates Rankine's theory incompatible with reality. Coulomb's assumption of hydrostatic distribution valid only in special case of sand on retaining walls capable of yielding indefinitely. For sand on timbering of cuts, arching occurs between timbering and soil, which eliminates hydrostatic pressure distribution.

297—Terzaghi, K., "Arching in Sands," *Eng. News-Rec.*, May 14, 1936, Vol. 116, pp. 690–693. **(E)**

Elementary discussion of mechanics of arching in sand above tunnels, around shafts, and behind retaining walls.

298—Terzaghi, K., "Beanspruchung von Gewichtsstaumauern durch das strömende Sickerwasser" (Stresses in Gravity Dams Due to Flowing of Seepage Water), *Die Bautechnik*, July 6, 1934, Vol. 12, pp. 379–382. **(F)**

Computation of state of stress in concrete gravity dams subject to seepage pressure of percolating water. Analysis of influences of degree of permeability of fissured rock foundation and of grout curtain on effective state of stress in concrete.

299—Terzaghi, K., "Bodenpressung und Bettungsziffer" (Soil Pressures and Soil Coefficient), *Festschrift zum 25-jährigen Bestand des österreichischen Betonvereines*, 1932. (12 pages.) **(D)**

Detailed investigation of influence of shape and size of foundation and distribution of loads on material value of coefficient of subsoil reaction.

300—Terzaghi, K., "Critical Height and Factor of Safety of Slopes Against Sliding," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 1, pp. 156–161. **(D, E)**

Critical height of slopes in cohesive soils may be computed by simple graphical method, based on Swedish procedure involving assumptions of circular sliding surfaces. Examples given for slow outward movement of retaining walls; physical causes of this phenomenon.

301—Terzaghi, K., "Der Spannungszustand im Porenwasser trocknender Betonkörper" (Pressure Due to Capillarity in Drying Concrete Bodies), *Der Bauingenieur*, July 20, 1934, Vol. 15, pp. 303–306. **(D)**

Laboratory investigation of stress and strain produced in concrete by gradual desiccation.

302—Terzaghi, K., "Die Tragfahigkeit von Pfahlgründungen" (The Bearing Power of Pile Foundations), *Die Bautechnik*, July 18, 1930, Vol. 8, pp. 475–478; August 8, 1930, Vol. 8, pp. 517–521. **(D)**

Analysis of factors which determine settlement of pile foundations, with numerous practical examples.

303—Terzaghi, K., Discussion on "Proposed New Boston Building Code," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 3, pp. 240–242. **(B, D)**

Considerable risks involved in design of foundations on basis of allowable bearing values for soil, which have been established without regard for type of building. To obtain adequate basis for building codes necessary to investigate effect of given differential settlements on buildings of different types. Can be accomplished only by means of systematic condition surveys carried on over period of several years.

304—Terzaghi, K., "Distribution of the Lateral Pressure of Sand on the Timbering of Cuts," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 1, pp. 211–215. **(E)**

Computation of distribution of lateral pressure of sand on timbering of cuts, based on classical theory of intensity and distribution of pressure of granular materials on walls of bins. Results indicate distribution of lateral pressure on timbering of cuts never hydrostatic; distribution of pressure over sides of cut depends on amount of yield of lateral support and density of sand.

305—Terzaghi, K., "Effect of the Type of Drainage of Retaining Walls on the Earth Pressure," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 1, pp. 215–218. **(E)**

Computation of lateral pressure of very fine sand on back of retaining wall whose back is completely covered by filter. Effect of rainstorms on intensity of lateral pressure eliminated by replacing vertical filter with inclined one.

306—Terzaghi, K., "Effects of Minor Geological Details on the Safety of Dams," Am. Inst. M. E., *Tech. Pub. No. 215*, February, 1929, pp. 31–44. (Discussion: pp. 44–46.) **(D)**

Geological factors determining degree of safety of storage dams and practical consequences of ignoring possibility of deviations from uniformity of subsoil.

307—Terzaghi, K., "Einfluss des Porenwasserdruckes auf den Scherwiderstand der Tone" (Influence of Pore-Water Pressure on Shearing Strength of Clays), *Deutscher Wasserwirtschaft*, 1938. (9 pages.) **(C)**

Analysis of influence of method of testing on shearing resistance of clay soils. On basis of results, author establishes rules for interpretation of test results.

308—Terzaghi, K., *Erdbaumechanik auf bodenphysikalischer Grundlage* (Soil Mechanics Based on Physical Properties of the Soil). Leipzig: Deuticke, 1925. **(A)**

The first complete text presentation of soil mechanics.

309—Terzaghi, K., "Festigkeitseigenschaften der Schuttungen, Sedimente und Gele" (Strength Properties of Fill, Sedimentary Materials, and Jelly-Like Materials), *Handbuch der physikalischen und technischen Mechanik*, Vol. 4, pp. 513–578. Leipzig: Barth, 1931. **(A)**

Condensed review of status of soil mechanics in 1930.

310—Terzaghi, K., "General Wedge Theory of Earth Pressure," *Proc.*, Am. Soc. C. E., October, 1939, Vol. 65, pp. 1327–1339. (E)

Earth pressures against vertical walls; comparison of wedge theory with Coulomb's; results of field tests.

311—Terzaghi, K., "Gleitwiderstand von Ankerblöcken für Hängebrücken" (Sliding Resistance of Anchors for Suspension Bridge), *Die Bautechnik*, July 29, 1938, Vol. 16, pp. 413–416; August 5, 1938, Vol. 16, pp. 427–431. (D)

Theory of anchorage of suspension bridges in clay beds. Review of existing anchorages of that type, and results of investigation of anchorage for suspension bridge across Danube in Vienna.

312—Terzaghi, K., "Large Retaining-Wall Tests," *Eng. News-Rec.*, February 1, 1934, Vol. 112, pp. 136–140; February 22, 1934, Vol. 112, pp. 259–262; March 8, 1934, Vol. 112, pp. 316–318; March 29, 1934, Vol. 112, pp. 403–406; April 19, 1934, Vol. 112, pp. 503–508. (Discussion: pp. 514–515.) (E)

Detailed description of results of large-scale earth pressure tests involving measurement of lateral pressure of sand in dry and saturated state, and of till in dry and saturated state on model retaining wall 14 ft long and 7 ft high, constructed by author at M. I. T. in 1929. These tests the first to furnish quantitative information on influence of lateral yield of retaining wall on intensity of lateral pressure.

313—Terzaghi, K., "Mechanics of Shear Failures on Clay Slopes and the Creep of Retaining Walls," *Pub. Rds.*, December, 1929, Vol. 10, pp. 177–192. (D)

Fallacy involved in Frontard's theory of stability of slopes in cohesive earth demonstrated; method for computing factor of safety of slopes in non-cohesive soils subject to seepage pressure of percolating water.

314—Terzaghi, K., "Record Earth-Pressure Testing Machine," *Eng. News-Rec.*, September 29, 1932, Vol. 109, pp. 365–369. (Discussion: November 3, 1932, p. 535.) (E)

Detailed discussion of earth-pressure apparatus at M. I. T. designed by author for making tests described in author's paper "Large Retaining-Wall Tests," (see **312**).

315—Terzaghi, K., "Retaining-Wall Design for Fifteen-Mile Falls Dam," *Eng. News-Rec.*, May 17, 1934, Vol. 112, pp. 632–636. (E)

Results of tests described in author's paper "Large Retaining-Wall Tests" (see **312**) applied to design of 160 ft retaining wall at boundary between concrete and earth section of storage dam.

316—Terzaghi, K., "Settlement of Structures in Europe and Methods of Observations," *Proc.*, Am. Soc. C. E., September, 1937, Vol. 63, pp. 1358–1374. (D)

Results of systematic settlement observations carried out by author and staff during period 1929–1936 in Vienna; description of hose level device and metal reference points used in surveys.

317—TERZAGHI, K., "Simple Tests Determine Hydrostatic Uplift," *Eng. News-Rec.*, June 18, 1936, Vol. 116, pp. 872–875. (C, D)

Laboratory tests demonstrate that both shearing resistance and void-ratio of soils depend solely on difference between total stresses and stresses which act in water contained in voids. Difference given name "effective state of stress," while stresses acting in water are called "neutral stresses."

318—TERZAGHI, K., "Soil Mechanics: A New Chapter in Engineering Science," *Jour.*, Inst. C. E., May, 1939, Vol. 12, pp. 105–140. (A)

The James Forrest Lecture given in London in 1939, briefly reviewing status of applied soil mechanics up to that time.

319—TERZAGHI, K., "Stability of Slopes of Natural Clay," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 1, pp. 161–165. (B, C)

Values obtained by laboratory tests for relation between normal pressure and shearing resistance of cohesive soils can be used only in connection with computation of stability of slopes in soft clays. Effective shearing resistance of stiff clays can be expected to be only small fraction of what resistance should be according to results of laboratory investigations. Illustrated by numerous practical examples.

320—TERZAGHI, K., "Stress Distribution in Dry and in Saturated Sand Above a Yielding Trapdoor," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 1, pp. 307–311. (E)

Experimental investigations of yield of trapdoor, pressure of sand on door, and similarity to retaining wall characteristics. Also ratio of vertical and horizontal pressures.

321—TERZAGHI, K., "The Actual Factor of Safety in Foundations," *Struc. Eng.*, March, 1935, Vol. 13, pp. 126–160; "Die Setzungen der Fundierungen und ihre Wirkung auf den Oberbau" (Foundation Settlement and its Action on Superimposed Buildings), *De Ingenieur*, 1935. (39 pages.) (D)

Knowledge of soil profile and physical characteristics of most compressible strata prerequisite for locating seat of settlement. If these data known, agreement between computed and observed settlements usually satisfactory. Conspicuous differences between computed and real settlements usually due to horizontal variations in compressibility of subsoil. Intensity and importance of secondary stresses produced by differential settlement depend to large extent on type of structure supported by foundation.

322—TERZAGHI, K., "The Shearing Resistance of Saturated Soils and the Angle Between the Planes of Shear," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 1, pp. 54–56. (C, D)

Evidence shows shearing resistance of soils depends solely upon difference between total normal stress on shearing surface and hydrostatic pressure which acts in water along same plane. Explains why real stress conditions for failure of cohesive soils are likely to be very different from what they should be according to Mohr's theory of rupture.

323—Terzaghi, K., "The Static Rigidity of Plastic Clays," *Jour. Rheology*, July, 1931, Vol. 2, pp. 253–260. (B, C)

Experiments concerning continuous flow of clay under influence of shearing stresses which are considerably smaller than stresses required to produce shear failure. Time rate of flow increases as shearing stress approaches stress required to produce shear failure.

324—Terzaghi, K., "Tragfähigkeit der Flachgründungen" (Bearing Power of Flat Foundations) *Vorbericht* des ersten Kongresses der internat. Verein. Paris: 1932. (24 pages.) (D)

Description of results of experimental investigations made in laboratory of author for purpose of determining settlement at different depths below surface of loaded soil.

325—Terzaghi, K., "Verbessertes Verfahren zur Setzungsbeobachtung" (Improved Methods for Settlement Observations), *Die Bautechnik*, September 22, 1933, Vol. 11, pp. 579–582. (D)

Description of improvements of device described in 285.

326—Terzaghi, K., "Zur statischen Berechnung der Gewichtsstaumauern" (On Static Calculations of Gravity Dams), *Die Bautechnik*, October 19, 1934, Vol. 12, pp. 589–592. (F)

Computation of state of stress in concrete gravity dam subject to seepage pressure of percolating water.

327—Terzaghi, K., and Fröhlich, O., *Erdbaumechanik und Baupraxis* (Soil Mechanics and Soil Mechanics Methods). Wien: Deuticke, 1937. (33 pages.) (A)

Elementary discussion of influence of soil mechanics on construction practice.

328—Terzaghi, K., and Fröhlich, O., *Theorie der Setzung von Tonschichten* (Theory of Settlement of Clay Strata). Wien: Deuticke, 1936. (168 pages.) (D)

Theory of settlement of clay beds under influence of vertical loads on assumption that flow of water occurs in vertical direction only. Covers all cases likely to be encountered in engineering practice with exception of those involving two- or three-dimensional flow.

329—Terzaghi, K., and Langer, K., "Verbesserte Schlauchwage zur Setzungbeobachtung" (Improved Rubber Tube Level for Settlement Observations), *Die Bautechnik*, June 1, 1934, Vol. 12, pp. 291–292. (D)

Description of new method for measuring settlement of buildings by means of hose level equipped with micrometer attachment. By means of this attachment, possible to reduce error involved in observations to order of magnitude of 1/500 in.

330—Terzaghi, K., *et al.*, "Settlements of Structures," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 3, pp. 79–87. (D)

General discussion of existing methods for predicting settlement of structures and their relative merit. Special attention called to possibility of important

settlements due to gradual consolidation of layers of clay located at considerable depth below surface of ground or below level of points of piles or pile foundations.

Terzaghi, K., (see also **135**, **144**, **145**, and **248**).

331—Thoreen, R. C. (see also **355**), "Comments on the Hydrometer Method of Mechanical Analysis," *Pub. Rds.*, August, 1933, Vol. 14, pp. 93–105. **(C)**

Theory and advantages of hydrometer method, based on Stokes' formula, for determination of grain size distribution in subgrade soil suspensions from readings of sensitive hydrometer; sodium silicate found best deflocculant; depths of settlement of grains of particular diameter; pipette method; beaker method; agreement of hydrometer method with other methods of mechanical analysis. (Bibliography.)

332—Tiedemann, B., "Ueber die Scherfestigkeit bindiger Boeden" (On the Shearing Strength of Cohesive Soils), *Die Bautechnik*, July 9, 1937, Vol. 15, pp. 400–403; July 30, 1937, Vol. 15, pp. 433–435. **(C)**

Report of Prussian Experimental Institute of Hydraulics and Shipbuilding on apparatus and methods used for determination of shearing strength of cohesive soils.

333—Timoshenko, S. P., *Theory of Elasticity.* New York: McGraw-Hill, 1934. (416 pages.) **(D)**

Stress and elasticity problems in two and three dimensions.

334—Tschebotareff, G. P., "Relation Between Observed Inequalities of Buildings in Egypt and Theoretical Stress Distribution, Based on Boussinesq Formulas," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 1, pp. 57–61. **(D)**

Investigations of settlement and load data from raft and other foundations lead to conclusion that Boussinesq formula is valid, but more accurate stress computation methods and more experiments needed.

335—Tschebotareff, G. P., "Settlement Studies of Structures in Egypt," *Proc.*, Am. Soc. C. E., October, 1938, Vol. 63, pp. 1541–1567. (Discussion: February, 1939, Vol. 64, pp. 344–350; May, 1939, Vol. 64, pp. 881–883; June, 1939, Vol. 64, pp. 1064–1068.) **(D)**

Observations of new buildings on many types of foundations. Comparisons with laboratory investigations based on soil mechanics principles.

336—Tschebotareff, G. P., "Some Practical Aspects of Soil Shear Testing," *Proc.*, A. S. T. M., 1939, Vol. 39, pp. 1023–1027. **(C)**

Factors affecting shearing resistance of soils. Limitations of standardization possibilities emphasized. Data on effect of test duration (clays) and bulking (sand).

Tschebotareff, G. P., (see also **130**).

U

337—United States Bureau of Reclamation, "Laboratory Procedure in Testing Earth Dam Materials," *Tech. Memo. No. 533*, 1936. (73 pages.) (C)

Details of test apparatus and procedure.

338—United States Engineer Office, Boston, Mass., "Compaction Tests and Critical Density Investigation of Cohesionless Materials for Franklin Falls Dam," April, 1938. (78 pages.) (B, C, G)

Report of District Engineer Laboratory experiments on critical density. Field tests of rolling, tamping, and vibrating equipment. Recommendations.

V

339—Veihmeyer, F. J., and Hendrickson, A. H., "The Moisture Equivalent as a Measure of Field Capacity," *Soil Sci.*, September, 1931, Vol. 32, pp. 181–193. (B, F)

Experimental data indicating that moisture equivalent is close measure of field capacities of fine textured soils, but not always of sandy soils; original experiments showing that moisture equivalent can be used to indicate field capacities of deep drained soils with no decided changes in texture or structure, with moisture equivalent ranging from about 30 percent to 12 percent or 14 percent. (Bibliography.)

340—Vetter, C. P., "Design of Pile Foundations," *Trans.*, Am. Soc. C. E., 1939, Vol. 104, pp. 758–778. (Discussion: pp. 779–811.) (D)

Analyzes behavior of group of piles. Design formulas given for foundations with battered piles.

341—Vierheller, H. A., "Lateral Loading Tests Made on Steel Bearing Plates," *Eng. News-Rec.*, May 6, 1937, Vol. 118, pp. 667–669. (D)

Lateral loading tests conducted at Emsworth Dam, Ohio River, near Pittsburgh, Pennsylvania, on two test monoliths, 18 in. apart, each supported by four H-section steel bearing piles driven through sand and gravel to rock. Loads applied with calibrated, hand-operated hydraulic jack several times in succession; then increased in increments of 1 ton per pile. Corresponding deflections accurately recorded.

342—Vogt, F., "Ueber die Berechnung der Fundamentdeformation" (On the Determination of Deformation of Foundations), *Abhandlinger Det Kgl Norske Videnskapsakademi.* Oslo, 1925. (35 pages.) (D)

Not available for abstracting.

343—Vreedenburgh, C. G. J., "Electric Investigation of Underground Water Flow Nets," *Proc.*, Int. Conf. Soil Mech.; 1936, Vol. 1, pp. 219–222. (F)

Mathematical analogy between equations of motion of electric current through any plate conductor and equations of ground-water flow used to explore flow net electrically, both for soils with isotropic and for soils with

anisotropic permeability. Results of experiment carried out with aid of electric analogy apparatus given for ground-water flow through contiguous regions (dam body and subsoil) of different isotropic permeability.

344—VREEDENBURGH, C. G. J., "On the Steady Flow of Water Percolating Through Soils With Homogeneous-Anisotropic Permeability," *Proc.*, Int. Conf. Soil Mech., 1936, Vol. 1, pp. 222–225. (F)

Ends of velocity vectors for piezometric rise gradient = 1, lie on velocity ellipsoid. Ellipsoid gives direction of flow and coefficient of percolation in any arbitrary direction. Flow net may be transformed linearly to potential flow through earth with homogeneous isotropic permeability.

W

WAHL, A. M., (see 223).

WATSON, J. B., (see 52 and 53).

345—WATSON, J. D. (see also 338), "A Triaxial Compression Apparatus for the Determination of the Stress-Deformation Characteristics of Soils," *Proc.*, A. S. T. M., 1939, Vol. 39, pp. 1046–1057. (B, C)

Advantages of triaxial compression test for determination of shearing strength of soils listed in contrast to disadvantages of direct shear test. Typical results on several soils from large number of triaxial tests included.

346—WATSON, J. D., "The Technique of Triaxial Compression Tests," *Civ. Eng.*, December, 1939, Vol. 9, pp. 731–733. (B, C)

Apparatus of Harvard design described; tentative procedure for tests outlined. Results of several tests.

347—WEAVER, W., "Uplift Pressure on Dams," *Jour. Math. and Phys.*, June, 1932, Vol. 11, pp. 114–145. (F)

Critical review of existing studies; mathematical discussion of problem, including dams with and without sheet piling; lines of seepage flow.

348—WESTERGAARD, H. M., "What is Known of Stresses," *Eng. News-Rec.*, January 7, 1937, Vol. 118, pp. 26–29. (I)

Mathematical discussion of old findings and new developments in interpreting results of tests and behavior of pavement in service; corner breaks in pavements and reaction offered by subgrade; coefficient of subgrade stiffness.

349—WHITE, L. (see also 223 and 224), "Progress Report of the Special Committee on Earths and Foundations," *Proc.*, Am. Soc. C. E., May, 1933, Vol. 98, pp. 770–820. (D)

Sums up investigation of settlements of structures erected on soils containing strata of fine grained saturated materials. Applications of equations of Boussinesq to computation of unit pressures. Method of Terzaghi by which settlements are computed from tests of undisturbed samples. Actual settlements of large structure on clay compared with computed settlements.

Several cases of actual observed settlements. Application of photoelastic method to determination of underground pressures.

350—White, L., and Paaswell, G., "Lateral Earth and Concrete Pressures," *Trans.*, Am. Soc. C. E., 1939, Vol. 104, pp. 1685–1700. (Discussion: pp. 1701–1732.) (E)

Report of committee on lateral earth pressures. Discards classic methods and starts with fundamental laws of elasticity.

351—Wilcoxen, L. C., "New Pile-Bearing Formula From Model-Pile Tests," *Eng. News-Rec.*, November 3, 1932, Vol. 109, pp. 524–526. (Discussion: March 16, 1933, Vol. 110, p. 355.) (D)

By means of simple apparatus made by author, impact tests made on model piles of 6 in. length. Settlements in different soils resulting from impacts of 0.001 ft-lb; 0.01 ft-lb; 0.1 ft-lb; 1.0 ft-lb gave wide range of suitable data. Results charted on log paper with axes of Wh/P and S yielded straight lines demonstrating pile formula to be: $P = Wh/S^n$.

Willis, E. A., (see **146**, **147**, **148**, **149**, and **355**).

Winfrey, R., (see **279**).

352—Winsor, F. E., Dore, S. M., and Fahlquist, F. E., "Surface and Subsurface Investigations: Quabbin Dams and Aqueduct," *Trans.*, Am. Soc. C. E., 1937, Vol. 102, pp. 679–736. (Discussion: pp. 737–752.) (C)

Symposium on permeability determinations, and geological and other preliminary engineering investigations.

353—Winterkorn, H. F., (see also **8**), "Adsorption Phenomena in Relation to Soil Stabilization," *Proc.*, 15th. Ann. Meet., High. Res. Bd., December, 1935, Vol. 15, pp. 343–355. (I)

After short theoretical analysis of different types of adsorption, sorptive or surface behavior of soil materials is explained on basis of main soil forming processes. Data given on surface character of soil material developed under varied conditions of weathering, and on possible change of this character by exchange adsorption (base exchange) and other surface reactions (soaps). Importance of these reactions for soil stabilization demonstrated.

354—Winterkorn, H. F., "Surface-Chemical Factors Influencing the Engineering Properties of Soils," *Proc.*, 16th Ann. Meet., High. Res. Bd., November, 1936, Vol. 16, pp. 293–301. (B, C, F)

Results of experimental study of influence of various exchange ions on engineering properties of soil, showing that physical character of natural soils, especially as pertaining to stability at varying moisture contents, can be changed to great extent by change of adsorbed ions.

355—Wintermyer, A. M., Willis, E. A., and Thoreen, R. C., "Procedures for Testing Soils for the Determination of the Sub-Grade Soil Constant," *Pub. Rds.*, October, 1931, Vol. 12, pp. 197–207. (C)

Procedure employed in testing soils in sub-grade laboratory of United States Bureau of Public Roads at Arlington, Virginia; mechanical analysis by com-

bined sieve and hydrometer method; computation of data given by mechanical analysis; diameter of soil particles in suspension; correction curves for use in hydrometer analysis; determination of liquid limit; plastic limit; plasticity index; centrifuge moisture equivalent, field moisture equivalent, shrinkage, volumetric change, and specific gravity.

WINTERMYER, A. M., (see also **145** and **149**).

356—WOODS, K. B., and LITEHISER, R. R., "Soil Mechanics Applied to Highway Engineering in Ohio," Ohio State Univ., Eng. Exp. Sta., *Bul. No. 99*, July, 1938. (5 pages.) **(A, C, D, G, I)**

Laboratory and field investigating procedure of modern highway department soil testing laboratory. All usual physical characteristic tests described. Embankment specifications, methods of field control, and making of soil profile. Subgrade treatment for various types of soils; field and laboratory studies of poor foundations; investigation and treatment of landslides and peat bogs. Description of low cost road design and construction. Highly practical development of family of curves for embankment construction control.

WORLD POWER CONFERENCE, (see **56** and **57**).

357—WYCKOFF, W. W., "Design of Earth-Fill Dams," *Jour.*, Am. Water Wks. Assn., January, 1936, Vol. 28, pp. 127–133. **(D, F, G)**

Principles of design of earth-fill dams, with special reference to rate of percolation, stability of foundation, cut-off walls, face protection, spillway, and outlet works.

Z

ZANGER, C. N., (see **26**).

MANUALS OF ENGINEERING PRACTICE

Pursuant to the policy adopted by the Board of Direction on October 12, 1925, the following Manuals have been published to date:

Manual No.	*Title*	*Price to Members*	*Price to Non-Members*
1	Code of Practice	$0.10	$0.20
2	Definition of Terms Used in Sewerage and Sewage Disposal Practice	0.20	0.40
3	Manual on Lock Valves	0.50	1.00
4	A Selected Bibliography on Construction Methods and Plant Applied to Bridges, Buildings, Dams, Hydro-Electric Plants, Roads, Sea Walls, Sewers, Tunnels, etc.	0.50	1.00
5	Charges and Method of Making Charges for Professional Services	0.25	0.50
6	An Epitome of the Report on Charges and Method of Making Charges for Professional Services (for the Use of Clients)	0.25	0.50
7	Government Services Available to Civil Engineers	0.25	0.50
8	Engineering and Contracting Procedure for Foundations	0.20	0.40
9	Erection of Steel Buildings	0.20	0.40
10	Technical Procedure for City Surveys	0.95	1.90
11	Letter Symbols and Glossary for Hydraulics	0.30	0.60
12	Construction Plant and Methods for Flood Control on the Lower Mississippi River and Similar Streams	0.50	1.00
13	Filtering Materials for Sewage Treatment Plants	0.30	0.60
14	Location of Underground Utilities	0.20	0.40
15	Definitions of Surveying Terms	0.20	0.40
16	Land Subdivision	0.60	1.20
17	Timber Piles and Construction Timbers	0.35	0.70
18	Selected Bibliography on Soil Mechanics	0.50	1.00

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